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A study of the effectiveness of five soil poisons for termites with special reference to beta naphthol.

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by

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The control of termites differs from the control of almost all other economic insects, because both their damage and points of entry are usually hidden from view. Furthermore, the methods used in the control of termites are usually effective only when applied by specially trained persons.

Until approximately fifteen years ago, copper shielding was the only satisfactory form of protection. Since this method was relatively expensive, especially for the control of existing infestations, commercial interests began work on the development of other methods of termite control. These methods consisted of treating the ground around and beneath infested buildings, and to some extent, treating certain understructural wooden members, with various chemicals having varying degrees of toxicity to termites. Since the effectiveness of these chemical methods had not been determined, and since copper shielding, properly applied, was known to be effective, federal and state entomologists recommended the latter method only.

At the present time a few of the leading entomologists are beginning to recognize the place of chemicals, not only in the prevention of initial infestations, but also in the control of existing infestations of termites. Creosote, zinc chloride and Wolman's salts have been used extensively by the wood preserving industry to make wood repellant or unpalatable to termites, thus preventing initial infestations; beta naphthol, paradichlorobenzene and arsenical salts have been used extensively by the termite control industry to establish toxic barriers around and beneath infested structures, thus controlling existing infestations.

Soil poisoning is a fundamental procedure in the chemical control of termites and is usually supplemented by wood treatment. Although soil poisons have been used for many years, there is little information available on the relative toxicities of the chemicals used.

It is the purpose of this paper, therefore, to present a comprehensive study of five of the chemicals most commonly used as soil poisons for termites, namely: orthodichlorobenzene, paradichlorobenzene, white arsenic, beta naphthol and pentachlorophenol.

Importance of the Problem and Review of Literature.

In recent years, numerous papers have been written on termites and their control for the express purpose of making the general public more "termite conscious". A few papers have been written as the result of scientific research. This situation is almost unique in the field of entomology, and since a large number of the popular articles have been written by men whose experience with termites has been practically nil, many erroneous impressions have been created in the minds of the general public. Papers of this latter type may be divided into three groups:

1. Articles, the authors of which know very little about termites,
2. Abstracts of original articles in which the abstractor supplements or misinterprets the statements of the original author,
3. Inadequate articles written by reputable entomologists.

One of the best examples of the first type of paper is that by Lawrie (1936). This is a very superficial article from numerous standpoints. To begin with, many errors such as "termites are a species of roach" have been made. Kofoid et al (1934 pg.1) state that "although their (termites) nearest relatives are roaches, they have been distinct from them for many millions of years". Further erroneous statements such as "the queen is unable to feed herself", and "....sexless workers and regular workers", have also been made. Since the primary queen upon the first establishment of the colony is able to feed herself, (Kofoid et al, 1934 pg.27) the statement that "the queen is unable to feed herself" is very misleading. Furthermore, the queen must continue to feed herself until the eggs have hatched and developed into workers of sufficient size to take over the duties of feeding the royal pair (Snyder,1924, Kofoid et al, 1934 pg.27). In the case of the higher termites (Termitidae) the queen, by a process of postembryonic growth, grows so large that she is unable to move and is then wholly dependent upon the workers for food (Snyder, 1924). Among the lower termites (Kalotermitidae) the queen always remains active (Snyder, 1924). Lawrie's next statement in connection with the occurrence of both sexless and regular workers is also erroneous, since Snyder (1924) states that the worker caste is composed of both sexes, but that they are always sterile. Not only has Laurie made numerous mistakes, but he has also made one very serious omission, since no mention is made of the use of shields for the protection of buildings from termites, although shielding has been long recognized as one of the best methods for the protection of certain types of construction (Snyder, 1935).

An example of the second type of paper is one written anonymously in 1929, a review of Ansell (1929). Ansell's article is quoted throughout in the review, but the author of the latter supplements Ansell's original statements by implying that the control of subterranean termites can be obtained by gassing the queen, and that the impregnation of wood is the most effective method for the control of termites. Since supplementary reproductives take the place of the primary pair if the latter are killed (Kofoid et al, 1934 pg. 28), the elimination of the queen is of little or no benefit. Further, Kofoid et al (l.c. pg. 500) state that "although many termites are killed by the treatment (fumigation), others return from the soil as soon as the volatile fumigant disappears. The effectiveness of the more volatile liquid fumigants disappears in less than three months". Moreover, there is no "most effective method", (consisting of one single procedure, such as the impregnation of wood) since three fundamental principles are employed in the control of subterranean termites (l.c. pg. 579), although all three may not necessarily be used in any one case. These principles are:

1. Make the structure or material which is to be protected inaccessible to termites,
2. Use wood which is unavailable as food or undesirable to termites as a source of food supply,
3. Discourage colonization or breeding of termites in the vicinity of the structure or material which is to be protected.

An example of the third type of paper is that by McDaniel (1930). This paper is on household pests in general, but the section devoted to the control methods of termites is very inadequate and misleading since the author implies that the control of termites is a relatively simple matter: the subject of shielding is "covered" by four and one-half lines of text, the injection of the highly inflammable material, kerosene, is advocated for wood treating, and the use of pyrethrum and sodium arsenite is recommended. These shortcomings have been eliminated in the bulletin issued by McDaniel in 1938. If anyone is to publish on termites and their control, he should especially emphasize the fact that amateurs should not attempt control measures in the belief that the control of termites is a simple matter. This statement applies to control both by shielding and by chemical treatments, since neither method can be successfully applied without a thorough knowledge both of the habits of termites and of house construction. McDaniel (1938), referring to chemical barriers, states that "it is practically impossible for the layman to apply these barriers properly, since special machinery and a quantity of high grade chemicals are necessary to effect an efficient barrier".

Numerous other articles have been written, a few of the best of which are by Baerg (1940), Miller (1929), and Turner (1937, 1940, 1941). Other popular articles of less importance are those of Clark (1927), Brown (1933), Huxley (1931), Marcovitch (1939) and Haseman (1935). "Our Enemy, the Termite" by Snyder (1935) is one of the best of the popular publications on termites and their control. Of the technical publications on termites, that by Kofoid et al (1934) is undoubtedly the best. This book is an excellent summary of the existing information on the life history and control of North American termites.

The following discussion is based principally on such eminent authorities as Kofoid et al (1934) and Snyder (1924, 1935) except where otherwise noted.

1. General Description

Termites are one of the more primitive types of insects living in the world today. From one standpoint, however, they are among the most highly developed insects known; they have evolved a colonial form of existence similar to that of the higher bees and wasps, that rivals, if not surpasses, the highest form of society evolved by man.

Termites usually encountered in the United States vary from one-quarter to one-half an inch in length. All forms, except the winged alates and primary kings and queens, are a creamy white in color. The latter forms are pigmented and may vary in color from reddish brown to black.

"The food of termites is primarily cellulose invaded by fungi, and is usually obtained from the wood within which their burrows are made. Except in the family Termitidae, this wood can be utilized only by the aid of other organisms, which distend the intestine in a swarming, seething mass of minute animals of several kinds belonging to the flagellated Protozoa, each consisting of a single cell. Associated with them are numerous bacteria and spirochaetes of various kinds. The bodies of these tiny Protozoans are crowded with wood fragments, whose digestion here is a necessary step in the ultimate utilization of wood in the economy of termites. ...., Associated with the termites (in the breakdown of cellulose) --- are the fungi which grow in wood, and some of which are responsible for its decay. The conditions favorable for termites are also favorable for fungi, and hence these two organisms are commonly found in close and lasting association .... no special relations between particular fungi and termites have been found. The fungi may be of value to termites in the preliminary softening of the wood, particularly during the incipient stages of the development of the colony, but their most important function is probably the fulfillment of protein and vitamin requirements of termites (Cook and Scott, 1933)." (Kofoid et al, 1934, pgs. 5, 6).'

2. Distribution

The northern and southern extreme limits of the distribution of termites throughout the world seem to correspond fairly well with the 50° F. annual isotherm (Emerson, 1936). Although termites are known to occur in every state of the Union, there is no available evidence indicating that they have been either spreading northward within historic time, or that they are increasing markedly in numbers in any locality (Emerson, 1936).

Blake (1940) states that "in New England, the northern boundary is the average winter isotherm of 21° F. and the average summer isotherm of 65° F., depending on which is the most southerly. (This is equal to Hopkins' equivalent isophane of 50° F.). Within this area the species (R. flavipes) are found, almost without exception, on non-alkaline, well-drained, sandy or gravelly soils; they are absent on alkaline, heavy, poorly-drained soils".

"The environmental requirements of termites seem to be so rigid that it is unlikely that a given species can become established in an environment very different from that in which it is native. A possible exception to the general rule that introduced species have not spread, is the case of Heterotermes tenuis, a native of Brazil, the Guianas and Panama. It is reported to have been introduced into St. Helena in 1840 and to have damaged houses and furniture although there is no evidence that it has spread to wild habitats on the island" (Emerson, 1936).

3. Economic Importance of Termites

The insect world plays a very important part in the every day economy of man. In the mind of the general public, most, if not all, of the activities of insects are harmful, but this is far from the case. Insects play a vital part in the fertilization of a large number of flowering plants (bees), supply us with food (bees), and provide us with other useful commodities such as shellac and silk. The role of insects in supplying us with useful commodities is not nearly as important as their role in the decomposition of dead plant and animal remains. Certain species are involved in the decomposition of animal remains while other species are involved in the decomposition of plant remains. The principal species responsible for the decomposition of wood (plant remains) are the termites and wood-boring beetles (Kofoid et al, 1934 pg. 5). The role of termites in the destruction of wood, therefore, is not a new one; it is one that it has been their function to fulfill for thousands of years. Whether or not the wood is in a forest or combined in the structure of a house, is of relatively little importance to them.

Only within recent years has the damage due to termites been recognized as such. One of the earliest references in modern American entomological literature to termites attacking wooden structures is that by Cook, (1873). In this instance, termites were attacking a greenhouse in Grand Rapids, Michigan. It is of interest to note that the author believes this to be the first record of termite infestation in the United States, and this in an area where termites are present in relatively small numbers. An early record of damage in and around Boston is that by Hagen (1876). According to Turner (1937), early dates of damage by termites are Cambridge, 1885, New York City, 1893 and 1909, Albany, New York, 1900, Ohio, 1894 and 1896 and Baltimore, 1898. Turner and Townsend (1936) state that "Britton reported damage to a building in South Norwalk (Conn.) in 1909. Other reports were received, one each in 1915, 1925, 1927, 1928, 1930 and 1931 .... Since 1931 termites have been found in a large number of houses."

Preceding 1928 there were very few reports of termite damage in the United States. A survey made by the New Jersey Agricultural Experiment Station showed that from 1900 to 1928, there was less than one inquiry per year submitted to the station. From 1928 to 1930, approximately twenty-five inquiries were received and after 1930, fifty to one hundred inquiries per year were received. Turner, (1937) explains this increase in reports of damage by:

1. Education of the public,
2. Activities of commercial control operators,
3. Large amount of speculative building during and after the World War, producing a large number of highly susceptible dwellings in infested areas.

To gain some idea of the percentage of wooden buildings infested in Connecticut, a survey was made by the Connecticut Agricultural Experiment Station (Britton, 1937). One hundred and sixty-five inspections were made by this station and of the buildings inspected, one hundred and sixteen were found to have termites. A large number of public buildings were examined and of one hundred and forty-four buildings with masonry and concrete floors, none known to be infested, twenty-four had termites and none were seriously damaged. Of three hundred and eighteen buildings with wooden floors and framework, none known to be infested, one hundred and two had termites and twelve were seriously damaged.

Connecticut lies in the northern part of the range of termites, and since roughly one-third of the wooden buildings previously mentioned were infested, it is safe to assume that this fraction would be much larger in more southern areas where termites are more abundant. This hypothesis is substantiated by Snyder's estimate (1927), that 80% of the frame buildings in New Orleans and 50% of the business buildings in Pasadena are infested with termites. From these figures it will readily be seen that termites are of major economic importance in the United States, and that adequate, inexpensive methods of control must be worked out.

Termites not only attack wood but also attack plants of a woody or semi-woody nature. Among those infested are: begonias, (Anon., 1905); stored cereals, (Anon., 1908); citrus trees, (Delcurto, Halstead and Halstead, 1925), (Hargreaves, 1929),(Smith, 1938); cocoa, (Froggatt, 1938); coffee bushes, (James, 1932), (Wellington, 1937); cotton, (Bedford, 1937); cowpeas, (Anon., 1908); geraniums, (Anon., 1905), (Anon., 1908), (Britton, 1915), (Cory, 1918); hemp, (Cherian, 1932); pecans, (Herrick, 1904), (Gossard, 1905), (Chittenden, 1906), (Barre and Conradi, 1909); sugar cane, (Isaac and Misra, 1933); tea, (Jepson, 1929), (Hutson, 1933), (Jepson, 1935), (Corbett and Miller, 1936). This is only a partial list of plants attacked by termites, but it will give some idea of the extent of their activities. Many different remedies have been proposed for the control of termites attacking living plants, but no standard method of control has been proposed for use under all conditions. Comstock (1879), was one of the first to recommend control measures for termites in living plants and advocated the application of hot water.

Delcurto, Halstead and Halstead (1925) recommend the use of carbon disulphide or cyanide solution for termites attacking citrus trees. In the case of termites attacking imported young citrus stock, Hargreaves (1929) recommends the use of carbon disulphide at the rate of 10 c.c. per plant injected into the ground 8" away, to a depth of 3". Paradichlorobenzene, at the rate of 1/4 of an ounce per plant in a circle of 3" radius from the tree and a depth of 2",is also effective (l.c.). Paris Green and carbon disulphide are effective against termites in mounds (l.c.). Smith (1938), in the case of trees over two inches in diameter, recommends that 1/4" or 3/8" holes be bored into the trunk of the tree and Paris Green blown in. The holes are then plugged with wax. If the trees are under two inches in diameter, the soil two to three inches down should be removed and the tunnels destroyed. Paris Green should be added to the soil and the base of the tree left exposed (l.c.). In the case of herbaceous plants, use paradichlorobenzene at the rate of 1/8 ounce per tree in holes twelve inches from the plant, eighteen inches apart and four inches deep (l.c.).

In the case of termites attacking cocoa, Froggatt (1938) recommends the use of a 5% solution of paradichlorobenzene and kerosene. This solution poured into the workings kills the termites without apparently injuring the tree.

Wellington (1937) states that termites attacking coffee bushes in Sierra Leone can be controlled by painting the stems of the infested plants with a solution of lead arsenate and calcium oxide. James (1932) states that fumes of burning sulphur and arsenic pumped into the larger nests of termites attacking coffee bushes is a successful means of control, and that paradichlorobenzene worked into the top layer of soil is successful when numerous small nests are present.

Termites attacking cotton can be best controlled by the application of a mixture of sawdust and Paris Green at the rate of 510 lbs. per acre. This reduced the losses of stand from 5% to .4%. Naphthalene applied at the rate of from 100 to 150 pounds per acre is not as effective as the above (Bedford, 1937).

Britton (1915) suggests the use of carbon disulphide as a possible remedy in the case of termites attacking geraniums. Cory (1918) states that a 1/10 of a 1% emulsion of pine tar creosote will not injure young rooted cuttings and will kill termites in forty-eight hours.

In the case of termites attacking hemp, Cherian (1932) states that crude oil emulsion applied around the roots in the early stages of infestation is of value.

Herrick (1904) was one of the first to recommend control measures for termites attacking pecan trees, advocating the use of commercial fertilizers rather than barnyard manures. Gossard (1905) recommended that the earth be removed from about the parts of the trees attacked and the subsequent treatment of these parts with boiling water and carbon disulphide. The use of pyrethrum, tobacco dust and sodium cyanide are also mentioned. Chittenden (1906) recommended the removal of old stumps, limbs, etc. which might serve as possible breeding places. Barre and Conradi (1909) recommended in addition that the soil about the base of the tree be well mixed with tobacco dust.

In the case of termites attacking sugar cane, Isaac and Misra (1933) state that the damage is worse in sandy and loamy soils. They recommend that crude oil emulsion at the rate of one gallon per acre be applied to the irrigation water in small gunny bags, from April to June. The bag is suspended so that the bottom of it just touches the surface of the water. The emulsion thus formed is carried to and protects the roots of the cane.

In the case of termites attacking tea, Jepson (1929) states that control can be obtained by boring a gimlet hole into the galleries and blowing in a dust of Paris Green by means of an enema syringe of ball pattern. Two or three squeezes equal approximately 1/12 of an ounce. Hutson (1933) states that records over a period of five years involving one million tea plants indicate that Paris Green at the rate of $3\frac{1}{2}$ lbs. per 1000 bushes is entirely satisfactory for the control of termites attacking tea bushes and that no injury results. Barium fluosilicate is not a successful substitute. Jepson (1935) states that although Paris Green is a successful means of control, the sound wood is injured. He advocates the use of petrol on nests of mound-building termites. Corbett and Miller (1936) state that only temporary protection can be obtained with Paris Green, lead arsenate, magnesium sulphate, arsenious oxide, mercury bichloride, kainit and castor cake when they are applied to the soil about the plant. They also state that the termites will leave if the plants are made vigorous by the application of commercial fertilizers.

Anon. (1937) states that grass-eating termites can be killed by the application of powdered white arsenic.

Sen (1938) conducted tests on the effectiveness of various fumigants for the control of termites attacking the host trees of *Laccifer lacca* Kerr, and came to the conclusion that petrol was the most effective of the fumigants tested.

For the control of termites attacking plants in general, Harris (1934) recommends the use of petrol as an effective fumigant. He also recommends the use of six ounces of carbon disulphide per plant as the cheapest and most efficient control method to date. Paradichlorobenzene and two proprietary soil fumigants have given good results in the treatment of trees and ornamental shrubs attacked below the ground level by termites (Harris, 1937).

In general, then, it will be seen that termites are a pest of major economic importance and attack wood in almost any form regardless of whether or not the wood is in the forest, in buildings or in plants of a semi-woody nature.

4. Life Cycle

The following discussion is limited to Reticulitermes flavipes and is based on Snyder (1935) except where otherwise noted.

Probably the best point at which to begin the discussion of the life cycle is with the establishment of the colony by the primary kings and queens. Contrary to the general impression, these colonies are not necessarily monogamous, i.e. consisting of one king and one queen, since in some cases one or more members of each sex may be present (Snyder, 1924). Polygamy exists normally among the supplementary reproductives (Snyder, 1924). Immediately after the swarming flight, pairing takes place and the swarmers become negatively phototropic. This was very convincingly demonstrated in an experiment performed in the laboratory in the Spring of 1940:

> Large numbers of workers, together with developing alates, had been collected in the field and placed in one pint Mason jars to which had been added a small amount of moist soil and wood. After about a week or ten days, it was noticed that winged alates were completing their development in the jars and were preparing to swarm, whereupon the jars, with the tops removed, were placed in large glass cylinders, 24" x 12", on the bottom of which had been placed sheets of moist paper toweling. A strong electric light was placed on the outside of the glass cylinder. Within a few moments, large numbers of swarmers emerged, crawled

and flew toward that side of the glass exposed to the light, and acted very similar to moths when they are attracted to an electric light at night. This "nervous, worried action" continued for about seven to ten minutes, suddenly all undirected action ceased, and the swarmers crawled toward the other side of the cage, away from the source of light. All individuals completed this migration in from five to ten minutes after the first individual started away from the light. They then began to break off their wings and soon 'pairing' began to take place. It was noted that shedding of the wings was not a necessary preliminary to 'pairing', as stated by Kofoid et al (1934 p.41), since occasionally 'pairing' of winged and dealated individuals took place.

After 'pairing', the swarmers seek a suitable location for the beginning of a colony; this is usually a piece of wood, lying on or partly buried in the ground. A small excavation is made, and after fertilization, the queen begins egg-laying. Incubation time varies, under laboratory conditions, from 30 to 50 days (Kofoid et al, 1934 p.41). All of the nymphs or young hatch from the eggs in the same general form as the parents and are active at practically all times. There is neither a grub stage nor a long resting, pupal stage. Although all the young appear to be alike upon hatching, after two molts they can be separated into the small-headed reproductive types and the large-headed sterile types. Most of the former attain short wing pads which gradually grow longer with each successive molt (Snyder, 1935).

Although the young nymphs do not go through a long pupal stage, they do have relatively short "quiescent stages". During these quiescent stages and following molts, marked changes in size and structure become apparent; but in general the most important changes, both external and internal, appear at the final molt.

In species of our native Reticulitermes, the large-headed forms develop into mature sabre-jawed soldiers and saw-toothed-jawed workers. The soldier develops from a worker-like form and the worker caste, therefore, may be merely an arrested stage of the soldier. Workers and soldiers develop to maturity in one year (Snyder, 1935).

The problem of whether the various castes are differentiated before or after birth is still unsolved, and a subject of much controversy at this time. The character of the progeny and the ratio between the numbers of the castes in the colonies vary not only with different groups of termites, but also with the age of the particular colony. Hence, a genetic or hereditary formula for termites would vary similarly and no general formula would suffice for all groups of termites. "Polymorphism", or the presence of different castes, some of them sterile, has ever been a troublesome stumbling block to the exponents of the various theories of evolution. Charles Darwin frankly admitted in his Origin of Species that his theory cannot explain how the characters of the sterile workers and soldiers - which do not reproduce - secure representation in the germ cells of the species.

Two theories have been advanced concerning this phenomemon, both based on observation and experiment. The first theory is that the young are all alike upon hatching, but differentiate into the various adult castes through the influence of such external factors of their immediate environment as food and the care they receive from the workers.

The adherents to the second theory claim that the young are not all alike at the time of hatching, but that the castes are hereditary. Some, if not all, of the different castes are distinguishable from the beginning, and the castes are therefore predetermined in the egg or embryo by internal factors.

It is the opinion of Snyder that the origin of the termite castes is due to internal causes; that they are hereditary and of germinal origin. He agrees with Thompson in that they are "segregants, in the sense of the offspring of Oenothera lamarckiana, arising generation after generation by the splitting and recombination of the genes of a heterozygous parent form".

A natural explanation is that the castes have originated by segregation from an unstable hybrid form whose progeny are not all similar to the parent which produced them. There do not seem to be any visible differences in the chromosomes in the germ cells of the various castes.

Dr. G. B. Castle of the University of California, as a result of experimental work, has recently advanced a third theory involving food inhibition (Snyder, 1935). In colonies where reproductive forms are fully functioning, the development of any additional young sexual adults is inhibited by the secretions of the parent reproductives (king and queen). These secretions are transmitted to the young by the grooming habit in which the young lick exudates from the bodies of the adults.

This theory appears to be the most plausible of the three and great interest will be attached to further studies with other kinds of termites. Castle's experiments were made only with colonies of the "damp-wood" termites of the Pacific Coast, a primitive, plastic type.

Beginning with the third instar, the young nymphs can be differentiated into three major groups, based on external appearance. The first group is composed of both sexes and develops into the worker caste, differing from the worker honey bees in that the latter are all of the female sex. Worker termites, as their name implies, do all of the routine work connected with the maintenance of the colony, such as caring for the eggs, gathering food for the young, feeding the young (up to and including the third instar), feeding the soldiers and the primary kings and queens, etc.

In connection with the guarding of the eggs by the workers, the writer has noticed on various occasions that only eggs containing full grown embryos were located near the tops of white pine stumps in the fall of the year. Possibly this fact indicates that the workers not only give extreme care to the eggs but also, by transporting them up to the vicinity of the workers employed in obtaining the food supply, have some conception of the fact that the eggs are ready to hatch. Another explanation might be that the workers carry the eggs up to a warmer spot during the day, since in every case the egg masses were found on the south or east side of the stumps in question.

The second group of third instar nymphs develops into the caste known as soldiers, whose main function is the protection of the colony. In all types of soldiers, the head and the mandibles are greatly altered from the type found in other castes and instars. The chitinous covering of the head is thick, hard and darkly pigmented, and the head is usually much enlarged. The mandibles are typically greatly elongated, becoming either massive, heavily toothed crushing weapons, as in the wood-dwelling termites, or slender, pointed piercing weapons, as in the two higher families, the Rhinotermitidae and the Termitidae. Another commonly encountered protective device which has been highly developed by the soldiers of several widely separated groups is the use of the secretions of the cephalic gland in the center of the head to deter, to stupefy or mechanically impede attackers. This gland is feebly developed and without a pore in the wood-dwelling termites (family Kalotermitidae), but in other termites opens by a pore, typically tiny, located in the center of the top of the head.

The third group develops into reproductives of various kinds.

Authorities differ in regard to the development of these reproductives and the subsequent role they play in the perpetuation of the colony. Nevertheless it has been well established that three distinct types of reproductives develop, known as primary reproductives, brachypterous or short-winged reproductives, and apterous or wingless reproductives. The primary reproductives are those which finally develop wings, become pigmented, and go through the complicated swarming and 'pairing' process previously described. The brachypterous and apterous forms serve as supplementary reproductives and probably function as the principal source of a large majority of workers, especially when the primary reproductives are killed or part of the colony becomes separated from the main colony.

While the rate of egg production by the primary reproductives usually remains quite low, the rate of egg production by the supplementary reproductives may become relatively high. A supplementary queen is capable of laying more eggs in a day than the primary queen lays in the first two years of the development of the colony (Kofoid et al, 1934 p.29). It is therefore very hard to explain the establishment of large colonies in two to three years unless the supplementary reproductives begin functioning as soon as they develop without waiting for some part, or the whole colony, to be left without the services of the primary king and queen. At the present time, however, there is no experimental evidence indicating that primaries function in conjunction with supplementaries.

For a more detailed discussion of the life cycle of the various species of termites, see Kofoid et al,(1934) , and Snyder (1935).

5. Control

Although termites have been studied by entomologists for many years, their true economic importance has been appreciated for only the past twenty years. Prior to this period, very few people recognized termites or their damage as such, and although many reports of the destruction of wood in buildings were undoubtedly recorded, termites were very rarely identified as being the causative organisms.

Cook (1873) was one of the first to identify termite damage to buildings as such, and stated that carbolic acid soap was an immediate but not permanent remedy. He also mentioned the possible use of cresylic soap and recommended the use of kerosene solutions of camphor and turpentine. The use of a fumigant, carbon disulfide, was recommended by Britton in 1910 as a possible remedy. It will be readily seen that these control measures are of a very transitory nature and would have little or no lasting qualities.

Up to this time, there had been very little work done on the bionomics of termites and their methods of control. It was not generally realized that subterranean termites live in the ground and build their tubes up to wooden buildings in search of a further food supply, that termites must maintain a contact with the ground to provide for their moisture supply, and that superficial treatments are inadequate. Even as recently as 1917 Garman made the statement that "with a knowledge of the habits of this insect, extensive losses need no be sustained. A free use of insect powder about the shelves on which books are kept, the injection of coal oil in timbers and the occasional use of carboh disulfide are all that is necessary to suppress them". Evidently at that time at least, Garman had never heard that for successful control, all contact of wood with the ground must be broken. As early as 1915 Herrick,however, had recommended that no wood be left in contact with the ground and that infested wood be replaced with sound wood.

Superheating, as a method of termite control, was experimented with in New Hampshire in 1922. Although temporary control was obtained, the termites in the ground were not killed and reinfestation occurred thereafter (O'Kane and Osgood, 1923). A mixture of Phinotas oil and water at a dilution of one half on one per cent was used as a soil poison and was effective in preventing the infestation of trap blocks placed on the surface of the treated soil, for the reported duration of the experiment (less than one year). Experiments on the thermal death point were also conducted. Termites were sealed in spruce blocks, and the blocks heated to and held at various temperatures. A summary of these results will be found on the following page.

Temperature Tests

(Adapted from O'Kane and Osgood, 1923)

Killing effects of heat on termites placed in center of spruce block 10"x 10"x 10".

No. of Insects	Temperature	Time	Results
10	68.0° C.	24 hrs.	all dead
10	68.0° C.	24 "	" "
10	62.5° C.	24 "	" "
10	62.5° C.	24 "	" "
10	57.0° C.	24 "	" "
10	55.0° C.	24 "	" "
10	55.0° C.	24 "	" "
10	51.0° C.	24 "	" "
10	49.0° C.	24 "	" "
10	49.0° C.	24 "	" "
10	49.0° C.	24 "	" "
10	35.0° C.	28 hrs.	2 dead 8 alive

It should be noted that the lethal temperature lies above 35° C.(for 24 hrs.).

Snyder (1927) was probably the first to recommend really sound methods of control. He stated that the only effective permanent means of protection was by proper construction and this fact is still generally recognized. At that time soil poisons had not been widely used and the only really effective method of control, other than proper construction, was by means of a metal shield. Shields were devised in the tropics to prevent termites from building tubes over the face of walls or other objects to gain entrance to the wooden members of buildings. Froggatt (1905), stated "....on the top of each (pile), a tin or zinc cap should be placed, for, although not everlasting, they help to keep the pests out of all other woodwork." Jack (1913) suggested the use of a "zinc ant course", consisting of strips of zinc laid on the first course of bricks and projecting one inch on each side of the wall. von Schrenk (1934) recommended the use of shields in his specifications for termite-resistant construction. Snyder (1926) estimated that the cost of installing a metal termite shield, together with the necessary repairs, varied from $500 to $2000, and that "by simply inserting a sheet of galvanized iron, zinc, or copper .... into the masonry and turning the projecting edges downward at an angle, communication of termites with the earth, where they obtain moisture, can be cut off". The installation of a shield is not the simple matter that Dr. Snyder has implied since all methods of termite control require technical knowledge and experience if they are to be effectively employed.

Muirhead (1937) discussed termite control problems in New England in six types of house construction, and recommended the installation of shields in five out of six cases. It is very hard to justify these recommendations in view of Turner's statement (1941) that in this area (New England), soil poisons should be used in four out of five cases. These statements emphasize the lack of agreement between termite control authorities as to the best methods of control, both in regard to effectiveness and to cost. Many other authors have recommended the use of shields but practically all of these recommendations are based on the recommendations of Snyder.

The use of shields properly applied, is undoubtedly the best method for the control of termites, if they are properly installed, but they have the disadvantages of not only being relatively expensive, but also of being very difficult of installation after the buildings are erected.

One of the principal reasons why entomologists have put little faith in chemicals for the control of termites is that practically all of the chemicals used prior to 1925 were either ineffective or improperly applied. Even as recently as 1934, McDaniel recommended the use of such a transitory mixture as kerosene and pyrethrum for the treatment of infested woodwork.

As recently as 1934, the California Termite Investigations Committee (Kofoid et al, 1934 p. 502) were unable to find that any soil treatment was a standard practise or that there were available conclusive experimental data or field observations supporting any such treatment, and this statement is probably true at the present time (1941). At the present time various agencies are conducting field tests on soil poisons, but little information on the results of these tests is available.

In view of these facts, the attitude of state and federal entomologists toward shielding is easily understood and it is principally through the continued success of a few commercial operators using soil poisons for termite control work that the true value of soil poisons is being realized. The principal soil poisons that have been used for the control of termites are: arsenates, arsenites, paradichlorobenzene, orthodichlorobenzene, beta naphthol, zinc chloride, creosote and various oil products.

Arsenates and arsenites have been used for many years in the successful control of termites in living plants (pg. 12), and many termite control operators have used compounds of arsenic successfully for the control of termites in buildings (Hockenyos, 1939).

A survey made by the California Termite Investigations Committee (Kofoid et al, 1934 p. 504) showed that the ground treatment most used in southern California was sodium arsenite, 10% solution, sprayed on the ground surface at the rate of one or two gallons per 100 square feet. Many failures of this treatment were reported. Failures were also reported after retreatment, and in some cases three or four repetitions of the spray treatment were made before control was obtained. In competition with the spray treatment was the so called "trench system", in which a shallow trench six inches deep was dug along the foundation walls, etc., and well-poisoned with a 10% solution of sodium arsenate. The effectiveness of the trench system was probably about the same as that of the spray treatment. Further tests were carried out using a 6% and a 2% sodium arsenite solution and drenching the soil under the house; 25 to 50 gallons of the 6% solution per 100 square feet, and 50 to 100 gallons of the 2% solution per 100 square feet. One year after these thorough treatments no infestation had been reported. The committee believes that "with large amounts of dilute solutions a thicker layer of treated soil is obtained, thus giving more effective treatment than small amounts of strong solution".

Kofoid et al (1934, p. 108) state that "one operator reports successful ground treatments with kerosene emulsion containing one ounce of sodium arsenite per gallon (8 gm / liter, approximately 1%). His routine for obtaining better penetration of the treatment is interesting. If the top soil is in the form of a dust, the treatments do not readily soak into the soil. In that case he first waters the soil, wetting it thoroughly, and then applies a treatment of three gallons of kerosene emulsion per 100 square feet (1.21 gal. / sq. m.). This treatment is allowed to soak into the soil, but before it has dried a second treatment is applied. The actual dosage is six gallons of kerosene emulsion per 100 square feet (2.41 gal. / sq. m.), which has proved to be an effective treatment."

Wolcott (1939) found that Paris Green or white arsenic was effective in the control of Heterotermes tenuis when applied to the tops of the nests or to the main tunnels.

Preliminary experiments on the influence of various soils on the rapidity with which arsenites are leached out show (Hockenyos, 1939) that the larger the soil particles, the more rapidly the poison is leached out. Retention was highest in a clay soil.

The possible health hazard encountered with arsenical compounds both during and after application, however, has lead Kofoid et al (1934) to state "developments since the publication of the first edition of this report make it desirable that we strengthen our recommendation that arsenic or compounds of arsenic be not used for ground treatment, or for any other purpose, in connection with the treatment for termites."

Paradichlorobenzene has been used extensively as a soil fumigant and has been especially recommended by both entomologists and pest control operators for the control of termites. Turner, in a personal discussion with the author, has stated that paradichlorobenzene is not always effective, since he has observed cases where termites have actually built their tubes through soil that had been recently treated heavily with paradichlorobenzene. Turner and Townsend (1936) state that paradichlorobenzene is apparently ineffectual in Connecticut because of low soil temperatures.

Snyder (1936) states that where there is danger of orthodichlorobenzene reaching the roots of ornamental plants, paradichlorobenzene may be used in its place. He mentions the fact that low soil temperatures decrease the toxicity of paradichlorobenzene.

Kofoid et al (1934, p. 511) state that the only fumigant (soil poison) which was found effective against subterranean termites for the duration of the test period was paradichlorobenzene and that it has been used for treating the infested soil under houses with much reported success. Where it has been used along foundation walls, one-half to one ounce per lineal foot of trench, it has also given good results. They recommend that the crystals be placed in a shallow trench and covered with tightly packed earth to prevent loss by evaporation.

Orthodichlorobenzene has been recommended for the control of termites by Snyder (1936). Orthodichlorobenzene differs from paradichlorobenzene, chemically, in the arrangement of the chlorine atoms about the benzene nucleus. At ordinary temperatures orthodichlorobenzene is a colorless liquid and has much the appearance of kerosene, whereas paradichlorobenzene is a white, crystalline solid. Although there has been no information published on the subject, entomologists believe that orthodichlorobenzene is more toxic to termites than paradichlorobenzene. Snyder (1936) states that "the most promising of the soil poisons for such use (where termite reconstruction is deemed by the owner to be impracticable or too expensive) is a full strength solution of crude liquid orthodichlorobenzene. This chemical should be applied after a trench has been dug 30 inches deep (in no case lower than the top of the footing) and at least 12 inches wide at the top around the foundation walls and piers supporting the main structure or porches, etc. The soil at the bottom of the trench should be saturated with full-strength orthodichlorobenzene at the rate of one gallon per ten linear feet. The soil should then be replaced to within three inches of the surface and the treatment repeated. Before making such application, all wood debris should be removed from near the wall of the building and any earthlike shelter tubes over the foundation walls, etc., should be broken off."

Snyder offers no experimental evidence, however, on the effectiveness of orthodichlorobenzene.

Turner and Townsend (1936) state that while orthodichlorobenzene has not been thoroughly tested in New England, in one instance it failed to prevent termite entry.

Beta naphthol has been used extensively by the wood-preserving industry and its effectiveness in this field is fairly well known. For specific tests on the effectiveness of this chemical as a wood preserver see "Proceedings of the American Wood Preservers' Association", volume 34, page 272. At ordinary temperatures it is a crystalline solid and since it is relatively insoluble in water, its effectiveness as a soil poison might be expected to be of much greater duration than that of other chemicals that are more soluble in water, such as the arsenates and arsenites. Beta naphthol has been used successfully for many years as a soil poison for termites (Hockenyos, 1940b), although its specific and relative toxicities to termites are unknown.

Zinc chloride has been used occasionally as a soil poison for termites. Hill and Holdaway (1934) controlled an infestation in stored wheat in the Federal Capitol Building in Australia by treating the soil in the following manner: the wood was removed from the floor, and the clay loam soil below thoroughly moistened with water. The soil was then sprayed with a 10% solution of fused zinc chloride at the rate of .8 ounces of zinc chloride per square foot. Termites attacked the replaced boards in one week, and the treatment was repeated with a 20% solution of zinc chloride to give an average concentration of 3.25 ounces of zinc chloride per square foot. No reinfestation occurred within one week. These results cannot be interpreted as being positive, since only one week elapsed between the treatment and subsequent inspection.

Creosote has been used for over fifty years by the wood preserving industry and is probably the best substance that has been developed to date for this purpose. Wood that has been pressure-treated with creosote has been widely and successfully used in nearly all types of building construction. However, since creosote itself has a strong objectionable odor, and wood treated with creosote is difficult to paint, its present day use is more and more restricted to railroad ties, fence posts, wooden bridges, and similar structures. So-called "transparent" creosotes, not possessing these objectionable properties, have been developed, but whether they are as effective as straight unprocessed creosotes is questionable. Most authorities believe that they are not. Since the penetration of creosote depends upon the tar content, creosote redistilled for tar removal has a high degree of penetration and water absorption. Tar gives a surface coating and prevents water absorption (Hunt and Garratt, 1938). Most wood-impregnating plants therefore, require that chemical tests be conducted on all creosote used to insure the necessary penetration and toxicity. Creosote has been used extensively as a soil poison for termites but because of the previously mentioned objection of odor, because soil treated with creosote tends to "ball-up" and crack, thereby allowing termites passage (Lyons, 1936), and because it is slightly soluble in water (3%) (Hunt and Garratt, 1938), its use is becoming more and more restricted.

Various oil products have also been used for the control of termites. Uichanco (1931) states that waste engine oil or kerosene is very effective on termites in nests (Australia) when applied in the following manner: a shallow trench is dug where the tunnels are connected with the house. This is filled with water until the soil is so thoroughly drenched that absorption becomes slow. Enough waste engine oil or kerosene is then poured into the trench to form a very thick film on the surface of the water. As the water soaks downward, the oil is drawn under the ground by surface tension, and through the communicating galleries of the termites and into the nests. One treatment was sufficient for the entire colony and no reinfestation occurred although oil used alone was a failure. This method is also effective in the control of ground-inhabiting ants.

Pentachlorophenol is a compound recently developed by commercial interests and is supposedly of high efficiency as a soil poison for termites.

In summary then, it will be seen that termite control involves the elimination of contact of wood with the ground and the establishment of a barrier between the wooden sections of the building and the ground. This barrier may take the form of either a metal shield or a chemical treatment of the soil adjacent to and under the structure in question. Shields when properly installed, are the most effective means of control so far developed but both their high cost and difficulty of installation in buildings already erected necessitate the development of a cheaper method of control, easier to apply. Soil poisons have been used for this purpose for many years, but there is little or no information available on which poisons are the best, how they function, and how long they will remain effective.

6. Recent experiments on soil poisons for termite control.

A knowledge of the fundamental physical and chemical characteristics of the soil is desirable both for operators and for experimentors, since soil poisons may react differently in different types of soils. Soils are made up of weathered rock and weathered plant remains, and are classified according to their particle size into gravels, coarse sands, fine sands, silts, clays and colloids. Since poisons penetrate a soil through the air spaces, soils made up of large particles will be penetrated much more rapidly and to greater depth than will soils made up of small particles. Assuming that an equal amount of water is present in both cases, poisons will penetrate sandy soils more rapidly and to a greater depth than they will penetrate silts and clays, and the amount of poison necessary to penetrate all the spaces in a unit volume of sandy soil will be much less than the amount of poison required to penetrate all the spaces in a unit volume of a clay soil.

Available air-space is only one of many factors governing the efficiency of a soil poison in any specific soil. Another very important factor is that of capillarity, or the ability of a soil to hold a liquid poison. Soils high in organic matter tend to hold most liquid poisons very strongly, although carbon disulfide and dichloropentane will be lost more rapidly from a clay soil than from a sandy soil (Hockenyos, 1940a). Capillarity, therefore, governs the evaporating level of liquid poisons from soils. In clays, this level is at one to one and a half inches and in sands, at seven to eight inches (Hockenyos, 1940a). Under laboratory conditions, Hockenyos (1940a) found that, of the liquids tested, water was the most strongly held, mineral oil and neutral creosote oil were the least strongly held, while creosote oil and tar acid oil were intermediate. He also found that water will replace mineral oils of low to medium viscosity, but that water replaces creosote with difficulty and vice versa. Another factor influencing evaporation is the color of the soil, since dark colored soils heat up faster than light colored soils, thereby increasing the rate of evaporation.

Two other very important phenomena of soils influencing the efficiency of soil poisons are those of absorption and ionic exchange. The first of these, absorption, is the process whereby certain water-soluble compounds, upon entering the soil solution, are held tenaciously in ionic form by the soil particles. The soil particles hold only a fixed percentage of any given compound in this manner, and thereby function more or less as a 'bank'. Some of the compound remains free in the soil solution and as this free portion is lost from the soil, either through leaching or through evaporation, more of the ions are released by the soil particles. The percentage of the absorbed ions is, therefore, more or less constant. The loss of certain inorganic poisons such as the arsenates and arsenites is materially retarded by this phenomenon. There is a large amount of literature available in the field of agronomy on the behavior of phosphates under these conditions but whether the facts established for the behavior of phosphates can also be applied to the behavior of arsenates is unknown, although tests with termites indicate that the relatively insoluble forms of arsenates are not nearly as effective as the soluble sodium arsenite (Hockenyos, 1940b).

After taking the above factors into consideration, Hockenyos (1938) proposed a laboratory method for the preliminary evaluation of soil poisons. This method consists of mixing a weighed amount of soil (40 grams) with a weighed amount of the toxicant to be tested. Two squares of toilet tissue are folded and placed in the bottom of a jelly glass, $3\frac{1}{2}$" x $2\frac{1}{2}$" x 2", and 10 to 15 c.c. of water added. Forty grams of the soil-poison mixture is placed in the glass and becomes moistened with the water already present. Worker termites are placed on the surface of the soil and their reactions observed.

Smith (1940) used this method in tests he conducted on diphenylamine and orthodichlorobenzene, except that he substituted washed sand for the silt loam used by Hockenyos. The following table is a summary of his results.

Relative effectiveness of orthodichlorobenzene and diphenylamine in laboratory tests in sand, against subterranean termites.

Orthodichlorobenzene				Diphenylamine			
Time (Hrs.)	1/250	1/500	1/1000	Time (Hrs.)	1/250	1/500	1/1000
1	N	N	N	1	N	N	N
4	DR	N	N	6	N	N	N
24	DR	N	N	20	A	A	N
30	DR	N	N	24	A	A	A
36	DR	N	N	48	A	A	A
48	DR	N	N	68	D	D	A
60	DR	N	P	96	R	R	D
72	P	P	P	120	A	A	R
				144	D	D	N
				168	R	R	N
				192	N	N	N
				216	A	N	D
				240	D	D	D

N -- No penetration
A -- Affected
D -- Dead
R -- Replaced
P -- Penetrated, no effect

Smith also found that termites were unable to penetrate soil having concentrations of diphenylamine as low as 1:2000, 1:4000, 1:8000 and 1:10,000. A concentration of 1:10,000 kept termites from penetrating for five months, while, a concentration of 1:8000 was effective for at least seven months. On untreated soil, termites entered in one hour and lived for at least three months. This data shows conclusively that under laboratory conditions, diphenylamine is much superior to orthodichlorobenzene as a soil poison for termites.

The principal criticism of this method lies in the fact that since laboratory conditions differ greatly from field conditions, results obtained under laboratory conditions cannot be directly compared with those obtained under field conditions.

To overcome this difficulty, the following method was proposed by Craighead (1939).

A STANDARD FIELD METHOD OF PROCEDURE
FOR MEASURING THE INSULATING VALUE OF CHEMICALS
WHEN APPLIED TO SOILS FOR SUBTERRANEAN TERMITE CONTROL.

I. OBJECTIVE:

To determine the comparative effects of various chemicals when applied to soils, on termites, decay and green vegetation, and with dosage based on chemical cost and the amount of active ingredient applied per unit of soil.

II. SELECTION OF SITE:

1. Site factors-

(1) Topography fairly level and free of areas subject to erosion, frequent flooding and high water-tables.

(2) Uniformity of soil type.

3. General distribution of termites over entire area essential and should be determined by-
   (1) Superficial evidence, i. e. presence of termites in wood debris on area.
   (2) In absence of (1), the placing of population stakes in the soil and arranged uniformly over the area several months prior to the establishment of the test.

III. PLOT ESTABLISHMENT:

1. The plot should be as nearly square as possible, or at least sufficiently compact to utilize a natural termite population.
2. The plot should be divided into 10 equal blocks. In each block each treatment, including population stakes, will be arranged at random. Thus, each block will include one stake for each concentration of each chemical, in addition to the untreated stake or stakes.
3. Each block should be laid out so that population and test stakes will be arranged on the vertices of equilateral triangles whose sides are 5 feet.
4. Population stakes should be considered as being test units. At least as many as ten per cent of total number of test stakes or a minimum of 10 should be used for any test series.
5. Provision should be made for using ten stakes for each variable represented.

6. Chart area to show location and distribution of all treatment and population stakes; also note the degree or degrees of infestation; i. e. medium, light and heavy.

IV. ESTABLISHMENT OF INDIVIDUAL TEST STAKES:

1. Preparation of ground-

(1) Where vegetation is present, remove that portion of it which covers the individual area to be treated.

(2) Make a hole approximately 15 inches in diameter and 19 inches deep removing about 2 cubic feet of soil.

2. Preparation of specimens-

(1) All stakes shall be Douglas fir or pine (shortleaf or loblolly), each 2 x 4 x 18 inches, with a 4 inch wedge on bottom end, cut from 2 inch sides. No pine stakes shall have more than 25% heartwood or 10 rings per inch. Wood with excess pitch must be avoided.

(2) Each stake shall be numbered, using 2 non-corrosive metal tags, one on each 4 inch side. Each chemical treatment and each concentration of chemical shall have a separate designation number.

3. Installation of chemicals:

(1) A high, a medium or standard, and a low dosage of each chemical shall be used for each test.

a. The standard dosage, alike for all investigators for comparison of work, shall consist of 1/2 pound of active ingredient per cubic foot of soil.

b. The rates of the high and low dosages shall be at the discretion of the operator.

(2) Dosages other than those under (1) may be used according to the judgment of the operator.

(3) Dosages other than the standard shall be determined on basis of chemical cost, or on the amount of active ingredient per unit of soil, or both.

(4) Thoroughly mix chemical with soil as it is being backfilled. Liquids should be applied with a spray gun or sprinkling can. Dry applications should be made by mixing the chemical with the earth in such a manner as to insure thorough distribution.

(5) Tamp the earth as it is being replaced, and make the surface level with the surrounding ground. All soil should be replaced to prevent settling.

(6) With treatment completed carefully drive the numbered stakes in the center of the treated area to a depth of 12 inches (previously marked on the stakes) and tamp the soil well.

(7) In the case of population stakes, prepare the ground, remove the earth, replace and tamp as for the chemical treatments and then drive the numbered stake in the manner noted above.

(8) As far as possible, plan to install the tests during the fall of the year, leave stakes undisturbed for 12 months, then make a 100 per cent examination, replace all stakes, packing the soil carefully as before examination. Examination should thus be made once annually thereafter for the duration of the tests.

(9) In establishing tests do not apply chemicals to soil immediately following a rain.

V. RECORDS:

1. At time of establishing plot-

(1) Keep complete record of chemical sources, concentrations used, diluents, etc.

(2) Soil-

Record type, general condition and pH.

(3) Weather conditions-

General notes should be taken on moisture and temperatüre conditions in the soil.

2. During period of test-

(1) Precipitation and temperature records should be taken from the nearest official weather station where such records are not available locally.

3. At time of annual inspection-

(1) When making examinations, remove each test stqke and each population stake with a minimum disturbance

of soil, examine thoroughly for attack by termites and decay and record observations as provided for in the accompanying data sheet.

(2) In inspecting the specimens, care should be taken not to probe, whittle or otherwise mutilate them, for at the time of succeeding inspections, such mutilations may be misinterpreted.

(3) Any populations stake so badly decayed or attacked by termites as to be unreturnable to the test area should be replaced by a new stake and noted in the records. These replacements make it possible to chart the distribution of termites over the plot from year to year,

(4) Where there is a heaving due to heavy frosts, or soil cracking due to baking, redrive stakes to original position, repack the soil tight against the stakes and note in records.

Dr. Wilford suggests notes be kept separately for each treatment and on 5 x 7 cards as indicated on the following page:

Treatment No. Date (Established
(Examined

Soil: Type- pH-

When treated- Condition
Moisture

When examined- Condition
Moisture

Examined by:

Locality:

STAKE NO.

		A	B	C	D	E	F	G	H	I	J
Status	Termites										
of	Decay										
	Vegetation										

Remarks

Legend:

Termites 0-none; 1-trace; 2-light; 3-medium; 4-heavy; 5-surface feeding; 6-base activity; 7-ground line

a-live; b-old work; c-stake replaced.

Decay 0-none; 1-trace; 2-light; 3-medium; 4-heavy; 5-surface mycelium; 6-in pockets; 7-ground line

c-stake replaced

Vegetation 0-none; 2-light; 3-medium; 4-normal; 5-stunted growth; 6-dying; 7-dead.

a-treated area; b-adjacent area.

This method also has many disadvantages:

1. Since ground infestations are very rarely uniform, a large number of replications of each treatment are necessary. If a true Latin Square arrangement of plots is employed, there must be as many replications of each chemical, concentration and method of application as there are different chemicals, concentrations and methods of application. For example, if three different chemicals at three different concentrations are applied by two different methods, making a total of 18 different treatments, there must be 18 (3 x 3 x 2) replications of each treatment or a total of 18 x 18 or 324 test areas. (In experiments set up by Hatfield at Nitro, West Virginia, 58 different treatments with only 8 to 10 replications of each treatment, are being experimented with.(Verbal statement from Hatfield)).

2. This method is intended to evaluate soil poisons ordinarily used under houses. In most cases, soil under houses is quite different in composition from the top-soil found in open, exposed areas. Also, soil under houses is greatly protected from vertical leaching. Therefore, results obtained under field conditions can at the most be comparative and not absolute. By this is meant that only the relative duration of toxicity can be obtained; no statement can be made in connection with the duration of toxicity under protected house conditions.

3. There has been no provision made for determining the content of

organic matter in the test area, although this factor may be of great importance in some cases (see page 74).

4. Long periods of time must elapse, three to five years, before any results of a definite nature can be obtained.

In view of these disadvantages, the following method of testing the relative effectiveness of soil poisons has been worked out, and will be used in the latter part of this paper.

I. OBJECTIVE:

To determine the comparative effectiveness of soil poisons for termites with dosage based on chemical cost and the amount of active ingredient applied per unit of soil.

II. SELECTION OF SITE:

1. Site factors-

(1) Topography fairly level and free of areas subject to erosion, frequent flooding and high water-tables.

(2) Uniformity of soil type.

(3) Uniformity of vegetative cover as to character of growth, density of shade, etc.

2. Area chosen should be protected against-

(1) Fire

(2) Animals

(3) Vandalism

III. PLOT ESTABLISHMENT:

1. The plot should be layed out in the form of a rectangle,

allowing 3 feet on the long axis for each chemical tested. If more than 15 chemicals are to be tested, two plots should be laid out each containing one half of the chemicals to be tested.

2. The plots in every case should be nine feet wide.

3. The plots should be arranged so that drainage, if any, is across the short axis of the plot rather than along the long axis of the plot.

4. Areas 9 feet by 3 feet are thus provided for the testing of each soil poison. This area is then subdivided into three, three foot square areas, one for each concentration of the poison to be tested.

IV. ESTABLISHMENT OF INDIVIDUAL TEST STAKES:

1. Preparation of ground-

(1) Where vegetation is present, remove that portion of it which covers the individual area to be treated.

(2) Make a hole approximately 14 inches square and 9 inches deep (removing about 1 cubic foot of soil).

2. Installation of chemicals:

(1) A high, a medium or standard, and a low dosage of each chemical shall be used for each test.

a. The standard dosage, alike for all investigators for comparison of work, shall consist of 1/2 pound of active ingredient per cubic foot of soil.

b. The rates of the high and low dosage shall be at the discretion of the operator.

(2) Dosages other than those under (1) may be used according to the judgment of the operator.

(3) Dosages other than the standard shall be determined on basis of chemical cost, or on the amount of active ingredient per unit of soil, or both.

(4) Thoroughly mix chemical with soil as it is being backfilled. Liquids should be applied with a spray gun or sprinkling can. Dry applications should be made by mixing the chemical with the earth in such a manner as to insure thorough distribution.

(5) Tamp the earth as it is being replaced, and make the surface level with the surrounding ground. All soil should be replaced to prevent settling.

(6) With treatment completed carefully drive a wooden stake in the center of the treated area.

(7) In establishing tests do not apply chemicals to soil immediately following a rain.

V. Testing Samples:

1. Obtain soil samples from the treated areas at the surface, and 9" and 15" below the surface immediately after treatment, monthly for 6 months, at 9 months, 1 year, 18 months, 2 years, and as long thereafter as necessary. Place the soil samples in 2 lb. cellophane bags.

2. Run two laboratory tests on each sample using Hockenyos method, as soon as the samples have air-dried.

   a. Make observations on these tests at 0, 1, 2, 4, 8, 12, 24, 48 and 72 hours and record the number of workers above, alive and paralyzed.

VI. RECORDS:

1. At time of establishing plot-

   (1) Keep complete record of chemical sources, concentrations used, diluents, etc.

   (2) Soil-

   Record type, general condition and percentage of organic matter.

   (3) Weather conditions-

   General notes should be taken on moisture and temperature conditions in the soil.

2. During period of test-

   (1) Precipitation and temperature records should be taken from the nearest official weather station where such records are not available locally.

The above method, although it does have the disadvantage of being partly a laboratory method, eliminates the influence of variation in infestation of termites, gives much quicker results, takes the percentage of organic matter into consideration, and should give fully as much information as the test previously outlined by Craighead.

Experimental Procedure

As previously stated, it is the purpose of this paper to present a comprehensive study of the effectiveness of beta naphthol as a soil poison for termites, and compare it with four other soil poisons; orthodichlorobenzene, paradichlorobenzene, white arsenic and pentachlorophenol. The experimental section in this paper will be divided into experiments on the following subjects:

I. A study of the effectiveness of beta naphthol as a soil poison for termites.

   A. Tests on the nature of the toxic action of beta naphthol.

      1. As a fumigant poison,

      2. As a stomach poison,

      3. As a repellent.

   B. Tests on the minimum amount of beta naphthol necessary to keep termites from penetrating treated soil.

   C. Tests on the influence of various properties of soils on the toxic action of beta naphthol.

      1. Influence of particle size (soil).

      2. Influence of particle size (beta naphthol).

      3. Influence of organic matter.

II. A study of the relative duration of toxicity of beta naphthol, pentachlorophenol, white arsenic, paradichlorobenzene and orthodichlorobenzene when used as soil poisons for termites under field conditions.

   A. Tests on the initial toxicity of the various chemicals.

Influence of organic matter.

B. <u>Tests on the uniformity of the toxic barriers established with the various chemicals.</u>

Penetration below level of original application.

C. <u>Tests on the permanence of the toxic barriers established with the various chemicals.</u>

1. Influence of weather.

    a. Temperature

    b. Precipitation

2. Influence of drainage.

Despite the fact that beta naphthol is used extensively as a termiticide, there is very little, if any, information available on the exact manner in which it functions. It is necessary, therefore, to determine its effectiveness as a fumigant poison, as a stomach poison, and as a repellent before work of a more complicated natnre can be attempted.

Since beta naphthol is usually applied to the soil in a solution of a volatile oil which upon evaporation leaves a water-insoluble residue, its effectiveness as a contact poison, after the volatilization of the oil, is probably very slight. Therefore, only determinations of its effectiveness as a fumigant poison, as a stomach poison and as a repellent will be made.

I. A study of the effectiveness of beta naphthol as a soil poison for termites.

A. Tests on the nature of the toxic action of beta naphthol.

1. As a fumigant poison.

To determine whether or not beta naphthol acts as a fumigant poison, strips of paper towelling, 1" x 6", were made into rings by notching the ends and pasting. The paste was allowed to dry, and the rings were then dipped into an alcoholic solution of beta naphthol. The rings were again allowed to air-dry, and were then suspended in one pint Mason jars. Twenty termites were placed in the bottom of each jar, along with a piece of untreated paper towelling. The humidity was maintained by moistening a strip of paper towelling and laying it across the mouth of the jar. After the cover was placed on the jar, a humidity of approximately 100% was obtained as evidenced by the condensation of moisture on the inside of the bottle. The results of this test are recorded in Table I.

It will be seen from the data that there was very little fumigant action during the first 210 hours. At 307 hours, 50% of the termites were dead, while after 499 hours, all were dead. In the control experiments, C_1 and C_2, only 20% of the termites were dead. These results indicate that beta naphthol, even at very small concentrations, acts as a fumigant poison.

The above experiments were run at room temperatures varying from about 20°C. to 23.5°C. Further experiments were conducted to determine if possible the effect of temperature on the fumigant action of beta naphthol. Four temperatures (22°C., 27°C., 32°C., and 37°C.), and three concentrations of beta naphthol in alcohol (10 g./100 c.c., 5 g./100 c.c., and 1 g./100 c.c.) were employed. Paper rings were prepared as before and dipped into the various solutions.

Since it was found impractical to maintain the proper condition of relative humidity (i. e. approximately 100%) at the increased temperatures with the procedure previously described, the following slightly modified method was worked out.

A circular piece of paper towelling, having the same diameter as the one pint Mason jars, was placed in the bottom of each jar and thoroughly moistened with water. Twenty worker termites were then added.

Table I

Elapsed Time in Hours	Experiment Number						
	I	II	III	IV	V	C_1	C_2
---	20 alive	20 alive	20 alive	20 alive	20 alive	20 alive	20 alive
18	20 alive	20 alive	19 alive 1 injured	20 alive	17 alive 3 dead	20 alive	20 alive
42	20 alive	20 alive	19 alive 1 dead*	20 alive	17 alive 3 dead	20 alive	20 alive
67	19 alive 1 dead	20 alive	19 alive 1 dead	19 alive 1 dead	17 alive 3 dead	19 alive 1 dead	20 alive
90	19 alive 1 dead	19 alive 1 dead	19 alive 1 dead	19 alive 1 dead	16 alive 4 dead	19 alive 1 dead	20 alive
114	18 alive 1 dead 1 stuck	18 alive 1 dead 1 stuck	18 alive 1 dead 1 stuck	19 alive 1 dead	16 alive 4 dead	19 alive 1 dead	20 alive
162	18 alive 2 dead	17 alive 3 dead	17 alive 3 dead	DRY water added	15 alive 5 dead	19 alive 1 dead	20 alive
186	18 alive 2 dead	16 alive 4 dead	17 alive 3 dead	5 alive 15 dead	14 alive 6 dead	19 alive 1 dead	20 alive
210	18 alive 2 dead	16 alive 4 dead	16 alive 1 paral[x] 3 dead	20 dead	13 alive 7 dead	19 alive 1 dead	20 alive
258	15 alive 5 dead	15 alive 5 dead	15 alive 5 dead	--------	12 alive 1 paral[x] 7 dead	19 alive 1 dead	20 alive
307	11 alive 9 dead	10 alive 10 dead	8 alive 12 dead	--------	9 alive 11 dead	18 alive 2 dead	20 alive
403	6 alive 14 dead	5 alive 15 dead	20 dead	--------	1 alive[0] 19 dead	18 alive 2 dead	18 alive 2 dead
499	20 dead	20 dead	--------	--------	--------	15 alive 5 dead	17 alive 3 dead

paral[x] -- paralyzed   * -- a reproductive   0 -- died from injuries

Efficiency of beta naphthol as a fumigant poison. In experiments I-V, treated rings were suspended in the respective jars, while in experiments C_1 and C_2 untreated rings were suspended in the respective jars.

In the first method, the moisture was supplied by means of a sheet of moistened paper held in the cover of the jar; rubber rings were not used, with the result that the glass cover was loose on the jar. By using rubber rings, the rate of evaporation was materially decreased. The treated rings were suspended as before, by means of a narrow strip of paper across the mouth of each jar.

Three replications of each concentration of beta naphthol were run at 22°C., 27°C. and 32°C (Fig. 1.). Since a temperature of 37°C. proved to be lethal to the termites, no experiments were conducted at this temperature (see "lethal death point", pg. 26).

It has been suggested by Kofoid et al (1934, pg. 376) that the toxicity of chemicals for termites be compared by determining the time necessary to kill 80% of the individuals, since some may be particularly hardy and thereby interfere with the results if the chemicals are judged on the basis of the length of time necessary to kill 100% of the individuals. The time to kill 80% has been determined for each concentration and temperature and is recorded in Table II.

It is evident from these experiments that beta naphthol acts as a fumigant poison and that this action is much more pronounced at 32°C. than at either 22°C. or 27°C., probably because beta naphthol volatilizes more rapidly at the higher temperature. It is true that the results at any one temperature are inconsistent, particularly at 22°C., indicating possibly that the jars were not sealed tightly, thereby allow- some of the gas to escape. Nevertheless, the data unquestionable indicates that beta naphthol acts as a fumigant poison and that it is more

TABLE II

Temp. °C.	Concentration	Time in days to kill 80 %
22°C.	1 g.	25 +
22°C.	5 g.	16
22°C.	10 g.	25 +
27°C.	1 g.	17
27°C.	5 g.	9
27°C.	10 g.	10
32°C.	1 g.	8
32°C.	5 g.	7
32°C.	10 g.	4.5

Time necessary to kill 80 % of individuals subjected to fumigant action of beta naphthol.

effective at high temperatures.

2. As a stomach poison (Tests on the efficiency of beta naphthol)

To determine the effectiveness of beta naphthol as a stomach poison, strips of paper towelling, 1" x 6", were made into rings by notching the ends and pasting. The paste was allowed to dry, and the rings were left in the laboratory and weighed from day to day. As soon as the ratio of weight gain or loss each day, to the weight of the individual rings, was the same for each ring, they were dipped in an alcoholic solution of beta naphthol. The rings were then left in the laboratory until the ratio was again constant. It was found by this method that each of the rings contained approximately 75 mg. of beta naphthol. Five treated rings and two untreated rings were each placed in the bottom of a one pint Mason jar. Twenty termites were added and a sheet of moist paper towelling placed across the mouth of the jar. The glass cover was then placed on the jar and firmly secured by means of the usual wire clamps.

All of the termites in the jars containing treated rings died within 72 hours, while only one of the termites in the control jars died in this period. Since the amount of paper eaten was not visible to the naked eye, beta naphthol at this concentration may be functioning also as a contact poison. In any case it is very toxic and the minimum lethal dose must be very small.

Table III

Elapsed Time in Hours	Experiment Number						
	I	II	III	IV	V	C_1	C_2
0	20 alive	20 alive	19 alive	20 alive	22 alive	19 alive	21 alive
12	19 alive 1 injur- ed	20 alive	19 alive	20 alive	22 alive	19 alive	21 alive
48	20 dead	20 dead	14 dead 5 alive	20 dead	12 dead 10 alive	1 dead 18 alive	21 alive
72	-------	-------	19 dead	-------	22 dead	1 dead 18 alive	21 alive
120	-------	-------	-------	-------	-------	1 dead 18 alive	21 alive

<u>The efficiency of beta naphthol as a stomach poison</u>. (Approximately 75 mg. per ring.) In experiments I-V, the termites were in contact with treated rings; in experiments C_1 and C_2, the termites were in contact with untreated rings.

3. As a repellent (Tests on the efficiency of beta naphthol.)

Experiments employing Hockenyos' method of testing soil poisons were conducted to determine the effectiveness of beta naphthol as a repellent. The method has been described under "Review of Literature, --recent experiments on soil poisons", page 38. Briefly, the method consists of adding air-dried soil to a jelly glass containing a small amount of paper and water. After the dry soil has become moistened with the water, worker termites are placed on the surface, and observations made at fixed time intervals. If there is no poison, or an insufficient amount of poison in the soil, the termites will not be repelled, and will be able to penetrate the soil.

In the following experiments, small amounts of poison were mixed with soil in the following manner: 30 grams of air-dried soil (± .1 g.) were weighed on a rough balance, and then spread uniformly over a square of wax paper. The poison was ground to a fine powder in a mortar, and small amounts (2 grams, 1 gram, .5 grams, .1 grams, ± .001 grams) were weighed on an analytical balance. The weighed amount of poison was distributed over the soil on the wax paper, and then mixed by bringing the opposite edges of the paper together. The other two edges were brought together, and finally the original two edges were brought together again. The soil-poison mixture was spread on the wax paper by means of a spatula and remixed. This process was repeated three times, ensuring thorough mixing of the sample.

Five samples of poisoned soil for each concentration of chemical, and five samples of unpoisoned soil, were prepared and placed in separate jelly glasses, $3\frac{1}{2}$" x $2\frac{1}{2}$" x 2", to which 10 c.c. of water and two squares of toilet paper, folded into a one inch square, had been added. After the soil had become thoroughly moistened, ten worker termites were placed in each glass, and observations made at various time intervals. The results are shown in Table IV.

An analysis of the data in Table IV shows conclusively that termites are repelled by the concentrations of beta naphthol used, since with the exception of the cases indicated, they were not able to penetrate the treated soil. However, in two cases, where cracks formed in the soil, the termites were able to pass down and live on the paper in the bottom of the jar for the duration of the experiment (108 hours). Termites, when penetrating soil, pick up the soil particles in their mandibles and make a mound over and around their entrance. Where entrance holes in the form of cracks are already available, it is not necessary for the termites to excavate their own entrance holes, and penetration takes place, indicating that the repellent action takes the form of a disagreeable taste sensation.

B. <u>Tests on the minimum amount of beta naphthol necessary to keep termites from penetrating treated soils.</u>

To determine the minimum amount of beta naphthol necessary to keep termites from penetrating treated soils, laboratory experiments on five different soils were conducted as previously described (page 61), i. e. soil samples having various concentrations of beta naphthol were pre-

Table IV

Elapsed Time in Hours	Concentrations of Beta Naphthol				
	2g/30g	1g/30g	.5g/30g	.1g/30g	0.g/30g
---	50/50/0*	50/50/0	50/50/0	50/50/0	50/50/0
4	50/49/4	50/50/0	43[x]/50/0	36[x]/50/1	0/50/0
12	50/34/34	50/45/45	50/50/50	41[x]/49/40	0/50/0
36	50/0/0	50/0/0	50/0/0	41[x]/9/0	0/50/0
60	50/0/0	50/0/0	50/0/0	41[x]/9/0	0/50/0
108	50/0/0	50/0/0	50/0/0	41[x]/9/0	0/50/0

* -- Above/alive/paralyzed

x -- Crack in surface of soil through which termites were able to penetrate to the bottom of the jar.

The repellent action of beta naphthol.

pared, termites placed on the surface, and their reactions observed. Soils A, B and C were obtained at South Hadley, Massachusetts. Sample A was taken at a depth of from one to three inches below the surface, sample B, ten to thirteen inches below the surface and sample C, twenty-four to twenty-six inches below the surface. Soils D and E were obtained at Leverett, Massachusetts, Soil D being taken at the surface and Soil E at a depth of 12 inches. Four different concentrations, with five replications of each concentrations, were used. The results of these tests are contained in Tables V and VI. The total number of termites on the surface of the soil, the total number alive, and the total number paralyzed are recorded for each concentration and for each time of observation.

An analysis of these results shows that the concentration of beta naphthol necessary to keep termites from penetrating varies from soil to soil as follows:

Soil A	.08 g. / 30 g.
Soil B	.02 g. / 30 g.
Soil C	.02 g. / 30 g.
Soil D	.22 g. / 30 g.
Soil E	.02 g. / 30 g.

The experiments in the following section were performed to determine which factor or factors were influencing the toxic action of beta naphthol in the various soils.

Table V

Elapsed Time in Hours	Concentration of beta naphthol					
	.10g/30g	.08g/30g	.06g/30g	.04g/30g	.02g/30g	.00g/30g
	Soil sample A.					
0	50/50/0*	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	32/50/0	20/50/0	2/50/0	0/50/0
8	50/50/0	50/50/0	34/50/0	11/50/0	5/50/0	1/50/0
12	50/50/9	50/50/14	38/50/0	11/50/0	5/50/0	1/50/0
24	50/0/0	50/0/0	40/11/1	14/50/0	2/50/0	1/50/0
	Soil sample B.					
0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
8	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
12	50/50/50	50/50/50	50/50/50	50/50/50	50/50/50	0/50/0
24	50/0/0	50/0/0	50/0/0	50/0/0	50/0/0	0/50/0
	Soil sample C.					
0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
8	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
12	50/50/50	50/50/50	50/50/50	50/50/50	50/50/50	0/50/0
24	50/0/0	50/0/0	50/0/0	50/0/0	50/0/0	0/50/0
	Soil sample E.					
0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
8	50/50/30	50/50/25	50/50/25	50/50/10	50/50/0	0/50/0
12	50/50/50	50/50/50	50/42/42	50/50/38	50/50/35	0/50/0
24	50/0/0	50/0/0	50/0/0	50/0/0	50/0/0	0/50/0

* -- above/alive/paralyzed

The concentration of beta naphthol necessary to keep termites from penetrating soils A, B, C and E.

Table VI

Elapsed Time in Hours	Concentration of beta naphthol							
	.40g/30g	.30g/30g	.26g/30g	.22g/30g	.18g/30g	.14g/30g	.10g/30g	.00g/30g
0	30/30/0*	30/30/0	30/30/0	30/30/0	30/30/0	30/30/0	30/30/0	30/30/0
4	30/30/0	25/30/0	26/30/0	30/30/0	25/30/0	15/30/0	7/30/0	0/30/0
8	30/30/0	24/30/0	22/30/0	30/30/0	25/30/0	10/30/0	5/30/0	0/30/0
12	30/30/0	26/30/0	24/30/17	30/30/15	25/30/3	12/30/0	1/30/0	0/30/0
24	30/30/0	28/9/9 x	27/5/4 x	30/5/5	27/13/12	18/30/18	0/30/0	0/30/0

* -- Above/alive/paralyzed
x -- Cracks present, allowing entry

The concentration of beta naphthol necessary to keep termites from penetrating Soil D.

C. Tests on the influence of various properties of soils on the toxic action of beta naphthol.

1. Influence of particle size (soil).

A mechanical analysis of Soils A, B and C was made with large screens having the following mesh sizes: 20/inch, 40/inch, 60/inch, 80/inch and 100/inch; the results will be found in Table VII.

It will be noted that the percentage of each separate varied slightly from soil to soil, so, to make absolutely sure that particle size was having no effect on the toxicity of the beta naphthol, all of the soils were made up to the exact compositions given in the third column of Table VIII, all of the treated samples having a concentration of beta naphthol of .02 g. / 30 g. For example, the soil in test 2 was composed of the following percentages of the respective separates: 5%, 25%, 30%, 20%, 10%, 10%. The soil in test 1 is an original portion of Soil A that was not analyzed mechanically.

The three prepared soils were then tested for relative toxicity. Three control tests, consisting of the soil in the original condition, were also conducted. The results are contained in Table VIII. The termites were able to penetrate Soil A, regardless of whether or not it had the same composition as the other soils, but were unable to penetrate Soils B and C even when the latter had the same mechanical composition as Soil A, indicating that the size of the soil particles is not the principal controlling factor of the effectiveness of beta naphthol in these experiments.

Table VII

Particle Size	Soil					
	A		B		C	
	Weight	%	Weight	%	Weight	%
20 -	1.3	5.5	0.9	3.6	1.3	5.2
20 - 40	5.7	22.8	3.8	15.2	3.7	14.8
40 - 60	4.5	18.0	3.3	13.2	5.0	20.0
60 - 80	3.7	14.8	5.1	20.4	7.1	28.4
80 - 100	2.7	10.8	3.8	15.2	3.7	14.8
100 -	6.9	27.6	7.3	29.2	4.8	19.2
Total	24.6	99.4	24.2	96.8	25.6	102.4

Mechanical Analysis of Soils A, B and C.

Table VIII

TEST NUMBER	Sample	Composition of Sample	Concen-tration	Elapsed time in hours						
				1	2	4	8	12	24	30
1	A	Original	.02	1/10/0*	2/10/0	1/10/0	0/10/0	1/9/0	1/9/0	1/9/0
2	A	5/25/30/20/10/10	.02	2/10/0	1/10/0	1/10/0	0/10/0	0/10/0	0/10/0	0/10/0
3	B	Original	.02	10/10/0	10/10/0	10/10/0	10/10/3	10/10/7	10/2/2	10/0/0
4	B	5/25/30/20/10/10	.02	10/10/0	10/10/0	10/10/0	10/10/1	10/10/4	10/4/4	10/0/0
5	C	Original	.02	10/10/0	10/10/0	10/10/0	10/10/5	10/10/8	10/5/5	10/0/0
6	C	5/25/30/20/10/10	.02	10/10/0	10/10/0	10/10/0	10/10/1	10/10/4	10/5/5	10/0/0

* -- Above/alive/paralyzed

Influence of Particle Size on Toxicity

Table IX

Test Number	Sample	Composition of Sample	Concen-tration	Elapsed time in hours						
				1	2	4	8	12	24	30
1	A	50/50/0/0/0/0	.02	2/10/0*	0/10/0	2/10/0	1/10/0	0/10/0	0/10/0	0/10/0
2	A	0/0/0/0/50/50	.02	4/10/0	0/10/0	0/10/0	1/10/0	0/10/0	0/10/0	0/10/0
3	B	50/50/0/0/0/0	.02	10/10/0	10/10/0	10/10/0	10/10/1	10/10/8	10/3/3	10/0/0
4	C	0/0/0/0/50/50	.02	10/10/0	10/10/0	10/10/0	10/10/3	10/10/3	10/5/5	10/0/0
5	A	50/50/0/0/0/0	--	2/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0
6	A	0/0/0/0/50/50	--	2/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0
7	B	50/50/0/0/0/0	--	1/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0
8	C	0/0/0/0/50/50	--	7/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0

* -- Above/alive/paralyzed

Influence of Particle Size on Toxicity

To further test the possible influence of particle size on toxicity, soils composed of either very large particles or very small particles were made up and tested as before. The results of these experiments are contained in Table IX. It will be noted again that the termites were able to penetrate Soil A but not Soils B and C. Penetration was uniform in the untreated controls indicating again that particle size has little if any effect on the toxicity of beta naphthol under the test conditions.

2. Influence of particle size (beta naphthol). (Tests on the influence of various properties of soils on the toxic action of beta naphthol).

The following experiments were conducted to determine whether or not the particle size of beta naphthol has any bearing on its effectiveness as a soil poison.

The three soils obtained at South Hadley, Massachusetts were mixed with varying amounts of poison (Tables X and XI). In the first series of experiments, the toxicant was ground to a fine powder, the particles varying in size from about .01 inches to .02 inches. The reaction of termites to these soils was then obtained as previously described (page 61). It will be noted that concentrations of .08 g. of beta naphthol / 30 g. of soil A, and .02 g. of beta naphthol / 30 g. of soils B and C were necessary to keep the termites from penetrating (Table X).

Table X

Elapsed Time in Hours	Concentration of beta naphthol					
	.10g/30g	.08g/30g	.06g/30g	.04g/30g	.02g/30g	.00g/30g
	Soil sample A					
0	50/50/0*	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	32/50/0	20/50/0	2/50/0	0/50/0
8	50/50/0	50/50/0	34/50/0	11/50/0	5/50/0	1/50/0
12	50/50/9	50/50/14	38/50/0	11/50/0	5/50/0	1/50/0
24	50/0/0	50/0/0	40/11/1	14/50/0	2/50/0	1/50/0
	Soil sample B					
0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
8	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
12	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
24	50/0/0	50/0/0	50/0/0	50/0/0	50/0/0	0/50/0
	Soil sample C					
0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0
4	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
8	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
12	50/50/0	50/50/0	50/50/0	50/50/0	50/50/0	0/50/0
24	50/0/0	50/0/0	50/0/0	50/0/0	50/0/0	0/50/0

* -- Above/alive/paralyzed

The concentration of beta naphthol necessary to keep termites from penetrating soils A, B and C.

(Toxicant ground to a fine powder, but not sieved.)
(Particle size varied from about .01 to .02 inches.)

Table XI

Elapsed Time in Hours	Concentration of beta naphthol			
	.04g/30g	.02g/30g	.01g/30g	.00g/30g
	Soil sample A			
0	30/30/0*	30/30/0	30/30/0	30/30/0
4	30/30/0	20/30/0	5/30/0	0/30/0
8	30/30/6	20/30/0	4/30/0	0/30/0
12	30/30/9	20/30/2	3/30/0	0/30/0
24	30/7/7	17/29/7	1/30/0	0/30/0
	Soil sample B			
0	-------	30/30/0	30/30/0	30/30/0
4	-------	30/30/0	30/30/0	0/30/0
8	-------	30/30/14	30/30/13	0/30/0
12	-------	30/30/30	30/30/30	0/30/0
24	-------	30/0/0	30/3/3	0/30/0
	Soil sample C			
0	-------	30/30/0	30/30/0	30/30/0
4	-------	30/30/0	30/30/0	0/30/0
8	-------	30/30/12	30/30/10	0/30/0
12	-------	30/30/30	30/30/30	0/30/0
24	-------	30/5/5	30/0/0	0/30/0

* -- Above/alive/paralyzed

The concentration of beta naphthol necessary to keep termites from penetrating soils A, B and C.

(Toxicant ground to a fine powder and sieved)
(Particle size, .01 inches and smaller)

These same three soils were then retested, in exactly the same manner as before, except that the toxicant used was sieved through a screen having 100 holes to the inch. It will be noted that, using the finely powdered toxicant, concentrations of .04 g. of beta naphthol / 30 g. of soil A and .01 g. of beta naphthol of soils B and C were necessary to keep the termites from penetrating.

The results of these experiments clearly indicate that the efficiency of beta naphthol as a soil poison for termites is governed in part, at least, by the size of the toxic particles.

3. Influence of organic matter. (Tests on the influence of various properties of soils on the toxic action of beta naphthol.

To determine the effect of organic matter on toxicity, portions of soils A and D were heated in a porcelain crucible until all of the organic matter had been burned off. Thirty grams of the soil were then mixed with .02 grams of beta naphthol and tested for toxicity as before. A control test, consisting of untreated soil was also conducted (Table XII). It will be noted that in this case the termites were unable to penetrate both Soils A and D, indicating that the percentage of organic matter is an important factor in determining the toxicity of any treated soil.

A comprehensive summary of these experiments will be found on pages 265 to 266. At this time the following fact should be emphasized since it is of great significance in the experiments to follow.

Table XII

S O I L	Concentration of Beta Naphthol	Elapsed time in hours					
		1	2	4	8	12	24
A	.02	10/10/0*	10/10/0	10/10/4	10/10/4	10/0/0	10/0/0
A	None	3/10/0	2/10/0	0/10/0	0/10/0	0/10/0	0/10/0
D	.02	30/30/0	30/30/0	30/30/0	30/30/20	30/30/27	30/0/0
D	None	0/30/0	0/30/0	0/30/0	0/30/0	0/30/0	0/30/0

* -- Above/alive/paralyzed

The concentration of beta naphthol necessary to keep termites from penetrating soils A and D after organic matter had been removed.

By checking back through all of the pertinent tables, it will be found that in every case where termites were placed on untreated soil, penetration took place within two hours, and the termites never returned to the surface of the soil.

II. A study of the relative duration of toxicity of beta naphthol, pentachlorophenol, white arsenic, paradichlorobenzene and orthodichlorobenzene when used as soil poisons for termites under field conditions.

Field experiments were set up in Memphis, Tennessee, Richmond, Virginia, and Amherst, Massachusetts according to the outline given on pages 78 to 79.. Two plots, one on poorly drained soil, the other on well drained soil, were set up in Amherst, and one plot set up in each of the other two areas. The chemicals used were orthodichlorobenzene, paradichlorobenzene, beta naphthol, pentachlorophenol and white arsenic at concentrations of 2 lbs. / cu. ft., $\frac{1}{2}$ lb. / cu. ft. and $\frac{1}{4}$ lb. / cu. ft. Diagrams of these plots will be found on pages and .

Determinations of the percentage of organic matter, together with determinations of the pH, were made of soil samples taken from the surface, from a depth of 9 inches, and from a depth of 15 inches, in each of the four areas. The percentage of organic matter in each of the samples was determined by weighing approximately 5 grams accurately, of the air-dried soil to be tested. The sample was then heated in an alundum crucible until the weight became constant. The loss in weight incurred by this procedure was interpreted as representing the amount

Table XIII

Area	Depth of samples					
	Surface		9"		15"	
	% om*	pH	5 om*	pH	% Om*	pH
Memphis	6.4	5.0	3.4	5.0	3.7	5.5
Richmond	1.7	4.5	2.9	4.5	1.9	5.0
Amherst(WD)	6.5	4.0	6.4	4.0	6.1	4.0
Amherst(PD)	8.8	4.0	9.7	4.0	6.9	5.0

% om* -- percentage of organic matter

Determinations of the percentage of organic matter and pH of soil samples from test areas in Memphis, Richmond and Amherst.

Diagram of test plots in Memphis, Tennessee

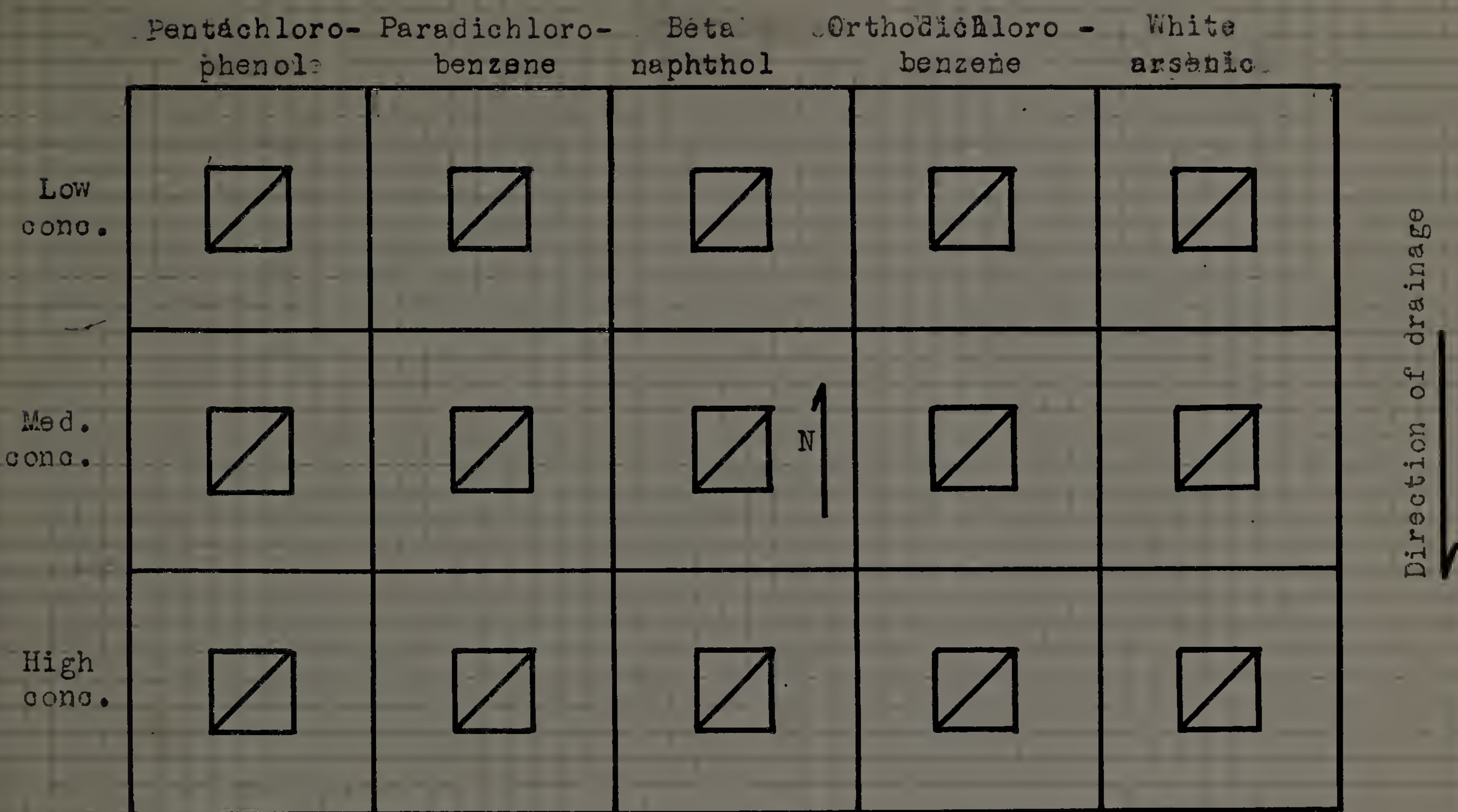
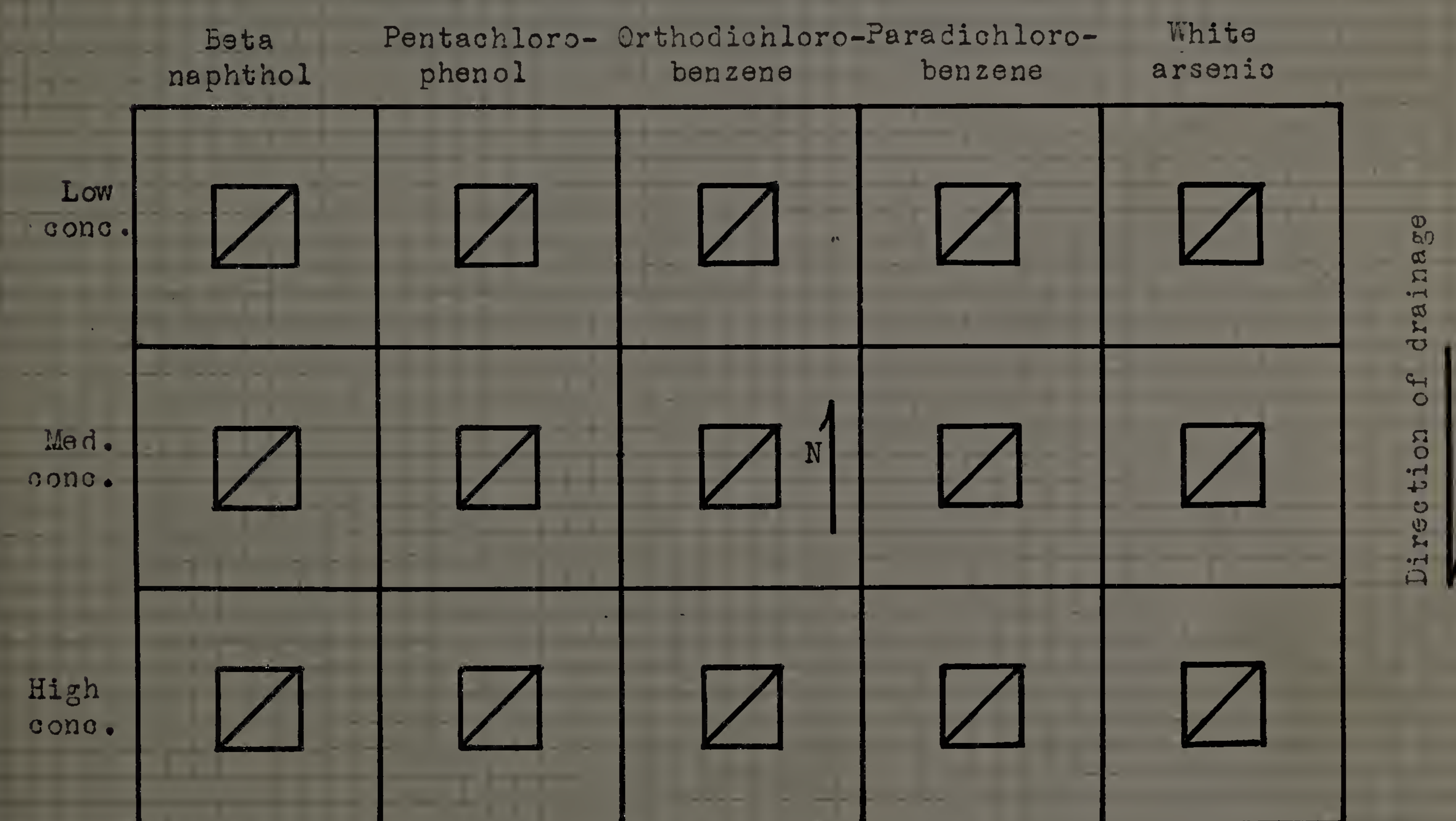


Diagram of test plots in Richmond, Virginia



 ---- Treated area

Scale: 3 squares equal 1 foot .

Diagram of test plots in Amherst, Mass., (Well drained)

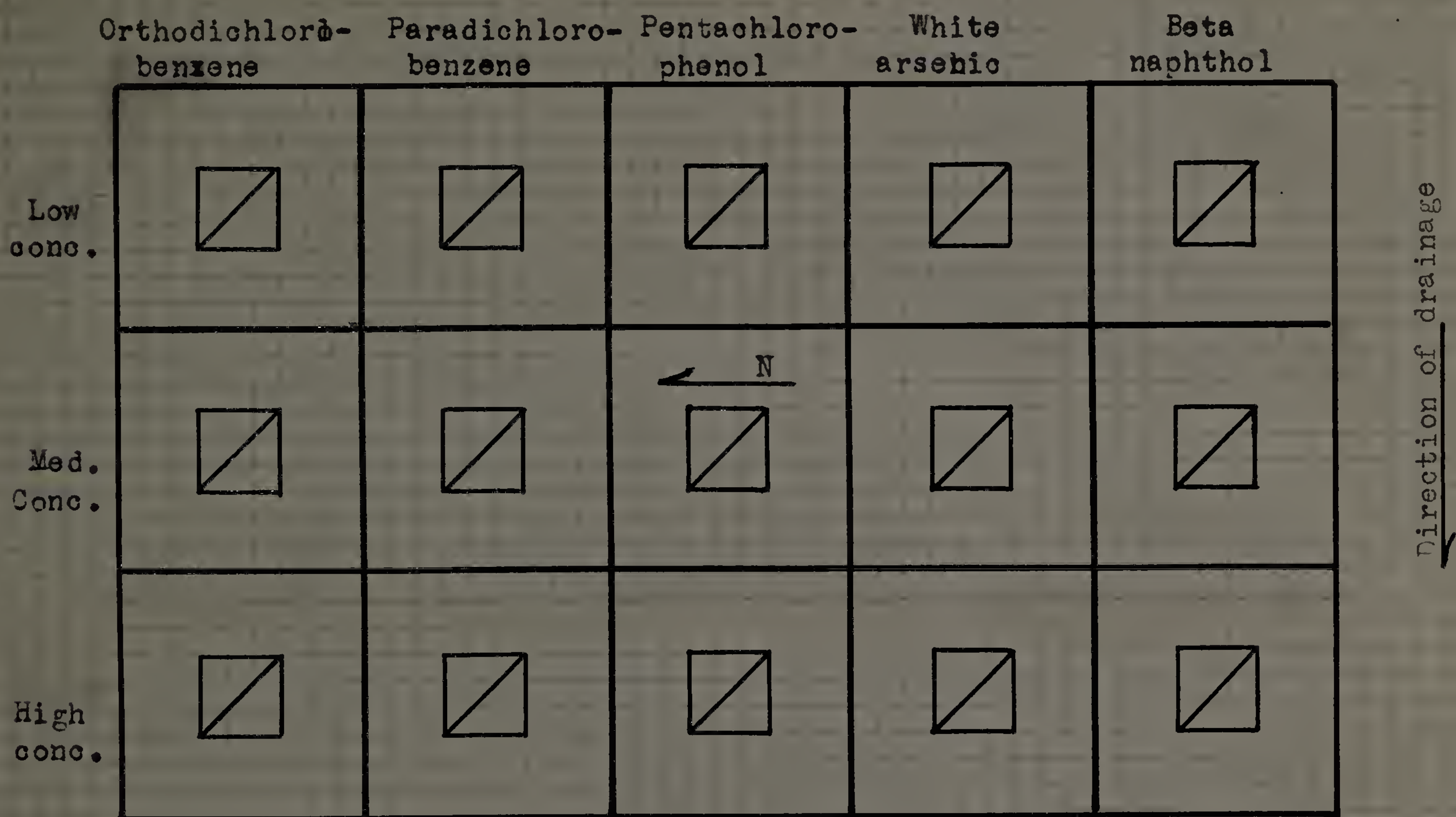
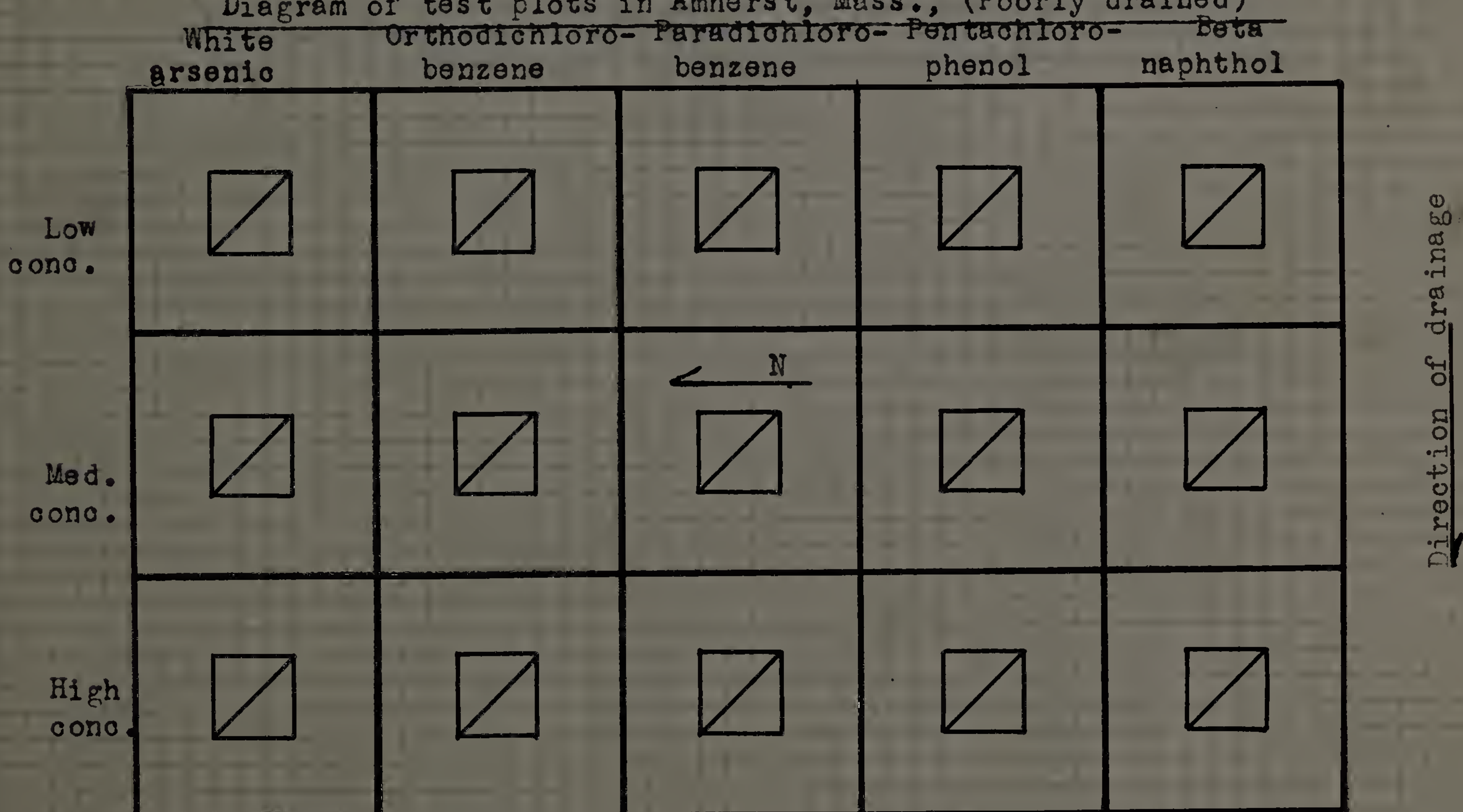


Diagram of test plots in Amherst, Mass., (Poorly drained)



 -----Treated area

Scale: 2 squares equals 1 foot.

of inorganic matter present in the original sample. Determinations of the pH of the various samples were made by means of a LaMotte Soil Teskit. The results of these determinations will be found in Table XIII.

A. Tests on the initial toxicity of the various chemicals.

Samples were taken at the surface and at a depth of 9" immediately after the poisons were applied, brought to the laboratory and allowed to dry. They were then sifted through ordinary screen wire and tested according to Hockenyos' method. Two tests were made of each sample. Observations were made at 1. 2, 4, 8, 12, 24, 48 and 72 hours and the number of termites on the surface, the number alive and the number which had penetrated, recorded. The results of these tests will be found in MEMPHIS TABLES I-O ---- V-O, RICHMOND TABLES I-O ---- V-O, AMHERST (WD) TABLES I-O ---- V-O and AMHERST (PD) TABLES I-O ---- V-O.

The following system of classification of results will be used in the following discussions:

No. of termites dead		Term descriptive of results
0	-----------	negative
1 - 10	-----------	slightly toxic
11 - 15	-----------	toxic
16 - 20	-----------	Very toxic

The following tables and graphs are numbered according to:

1. Origin of samples

   Memphis, Tennessee

   Richmond, Virginia

   Amherst (Well drained), Massachusetts

   Amherst (Poorly drained), Massachusetts

2. Toxicant used

   I - orthodichlorobenzene

   II - paradichlorobenzene

   III - beta naphthol

   IV - pentachlorophenol

   V - white arsenic

3. Time elapsed since the start of the field tests

   0 - 0 months

   1 - 1 month

   2 - 2 months

   3 - 3 months

   5 - 5 months

Example: Memphis[1] Table I[2]-0[3]

1. Memphis - origin of soil sample

2. Toxicant used - orthodichlorobenzene

3. 0 - immediately after application of chemical

The tables are grouped together in sections, each section consisting of tables and graphs giving results of tests on samples from one area at one time of sampling, a summary table and a discussion.

SECTION 1

MEMPHIS TABLE I-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with orthodichlorobenzene.

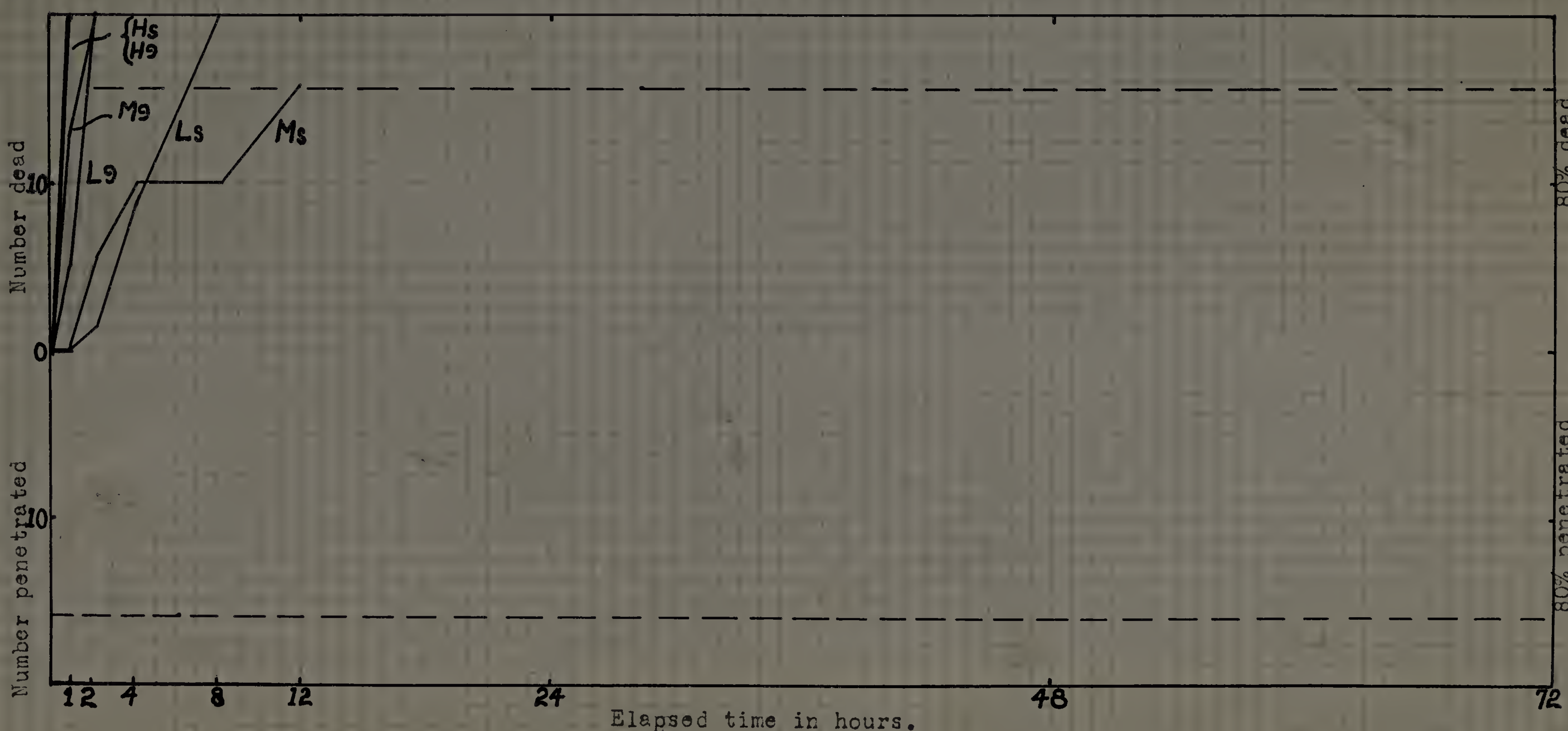
Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil	Elapsed time in hours.																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	20	0	20																					
H9	20	0	20																					
Ms	0	0	0	5	0	5	10	0	10	14	4	10	20	4	16									
M9	13	0	13	20	0	20																		
Ls	0	0	0	1	0	1	9	0	9	20	0	20												
L9	5	0	5	20	0	20																		

MEMPHIS GRAPH I-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with orthodichlorobenzene,

Based on arbitrary scores contained in MEMPHIS TABLE I-O
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



MEMPHIS TABLE II-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9";

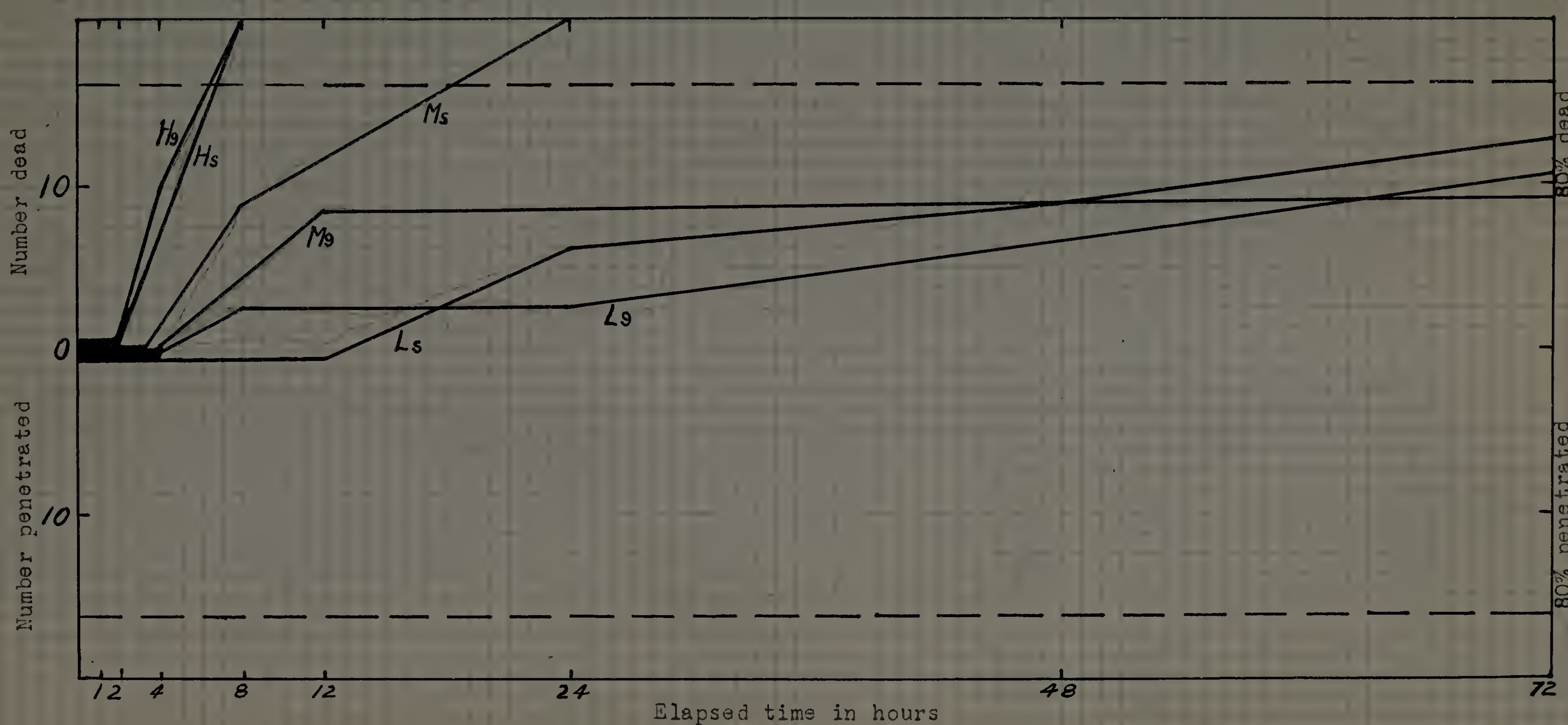
Elapsed time in hours.

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	7	0	7	20	0	20												
H9	0	0	0	0	0	0	9	0	9	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	8	0	8	12	0	12	20	0	20						
M9	0	0	0	0	0	0	0	0	0	4	0	4	8	0	8	8	0	8	8	0	8	9	0	9
Ls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	8	0	8	12	0	12
L9	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2	5	0	5	10	0	10

MEMPHIS GRAPH II-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with paradichlorobenzene.

Based on arbitrary scores contained in MEMPHIS TABLE II-O.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



MEMPHIS TABLE III-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with beta naphthol.

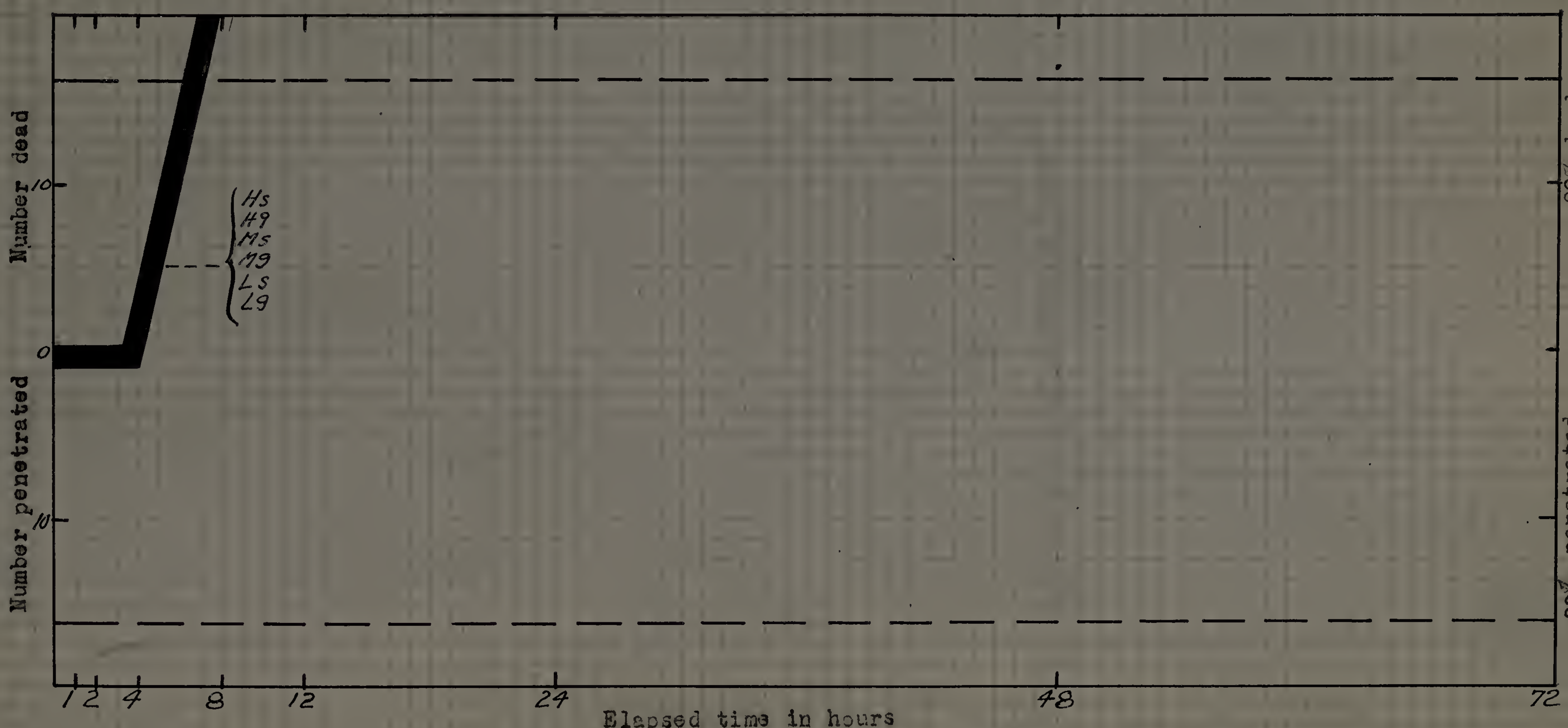
Two tests, each using 10 termites, run on each soil sample; the total number which are dead shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	20	0	20												
H9	0	0	0	0	0	0	0	0	0	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	20	0	20												
M9	0	0	0	0	0	0	0	0	0	20	0	20												
Ls	0	0	0	0	0	0	0	0	0	20	0	20												
L9	0	0	0	0	0	0	0	0	0	20	0	20												

MEMPHIS GRAPH III-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with beta naphthol.

Based on arbitrary scores contained in MEMPHIS TABLE III-O.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



MEMPHIS TABLE IV-C

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with pentachlorophenol.

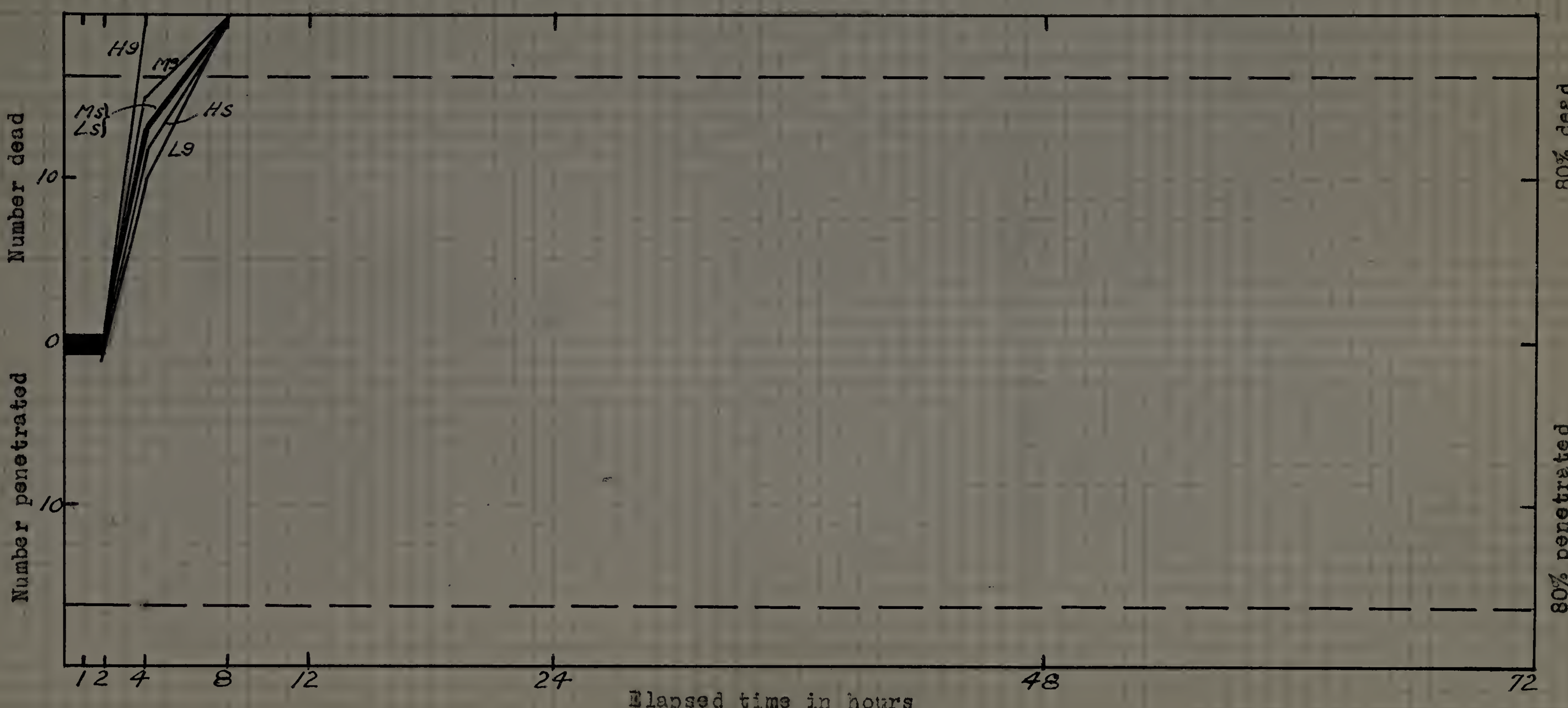
Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	12	0	12	20	0	20												
H9	0	0	0	0	0	0	20	0	20															
Ms	0	0	0	0	0	0	13	0	13	20	0	20												
M9	0	0	0	0	0	0	15	0	15	20	0	20												
Ls	0	0	0	0	0	0	13	0	13	20	0	20												
L9	0	0	0	0	0	0	10	0	10	20	0	20												

MEMPHIS GRAPH IV-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with pentachlorophenol.

Based on arbitrary scores contained in MEMPHIS TABLE IV-O.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



MEMPHIS TABLE V-O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with white arsenic.

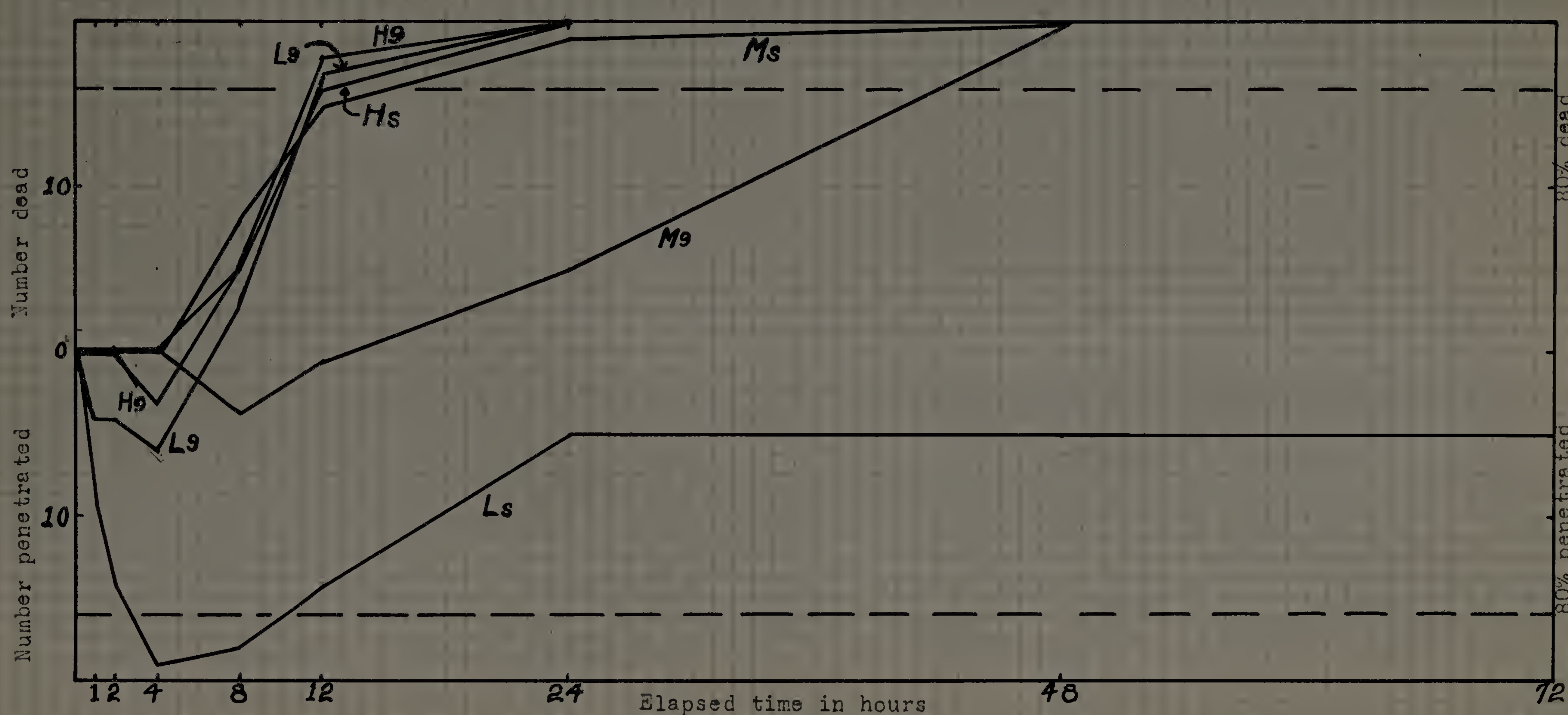
Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which are penetrated shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil No.	Elapsed time in hours. 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	2	-2	4	0	4	16	0	16	20	0	20						
H9	0	0	0	0	0	0	0	0	0	4	0	4	18	0	18	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	8	0	8	15	0	15	19	0	19	20	0	20			
M9	0	0	0	0	0	0	0	0	0	1	4	-3	4	5	-1	10	5	5	20	0	20			
Ls	0	9	-9	0	14	-14	0	19	-19	0	18	-18	3	17	-14	11	16	-5	11	16	-5	11	16	-5
L9	0	4	-4	0	4	-4	0	6	-6	7	4	3	17	0	17	20	0	20						

MEMPHIS GRAPH V-0

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with white arsenic.

Based on arbitrary scores contained in MEMPHIS TABLE V-0.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



MEMPHIS TABLE O

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with various chemicals.
(Based on MEMPHIS TABLES I-O, II-O, III-O, IV-O and V-O.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale): 1 2 4 8 12 24 48 72
	Orthodichlorobenzene
Hs	x
H9	x
Ms	--------x
M9	x
Ls	--------x
L9	--x
	Paradichlorobenzene
Hs	--------x
H9	--------x
Ms	------------x
M9	--(9 dead)
Ls	--(12 dead)
L9	--(10 dead)
	Beta naphthol
Hs	--------x
H9	--------x
Ms	--------x
M9	--------x
Ls	--------x
L9	--------x
	Pentachlorophenol
Hs	----x
H9	----x
Ms	----x
M9	----x
Ls	----x
L9	--------x
	White arsenic
Hs	------------x
H9	------------x
Ms	------------x
M9	---x
Ls	--(11 dead)
L9	------------x

Discussion of Section 1

Results of tests on toxicity of soil from Memphis, Tennessee immediately after treatment with various chemicals.
(Based on Memphis Tables I-O ----- V-O)

Orthodichlorobenzene: Very good kills were obtained with this chemical in this particular soil. 80% kill was obtained in all cases in 8 hours or less.

Paradichlorobenzene: With this chemical, 80% kill during the duration of the experiment was obtained with only 3 of the 6 samples.

Beta Naphthol: All samples very toxic; 80% kill occurring in 8 hours or less in all samples.

Pentachlorophenol: All samples very toxic; 80% kill occurring in 4 hours or less, with the exception of one sample.

White arsenic: All samples, with one exception, sufficiently toxic to kill 80% of the termites in 48 hours or less, However, killing was not nearly as rapid as with orthodichlorobenzene, beta naphthol and pentachlorophenol.

SECTION 2

RICHMOND TABLE I-0

Toxic action to termites of soil from Richmond, Va., immediately after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

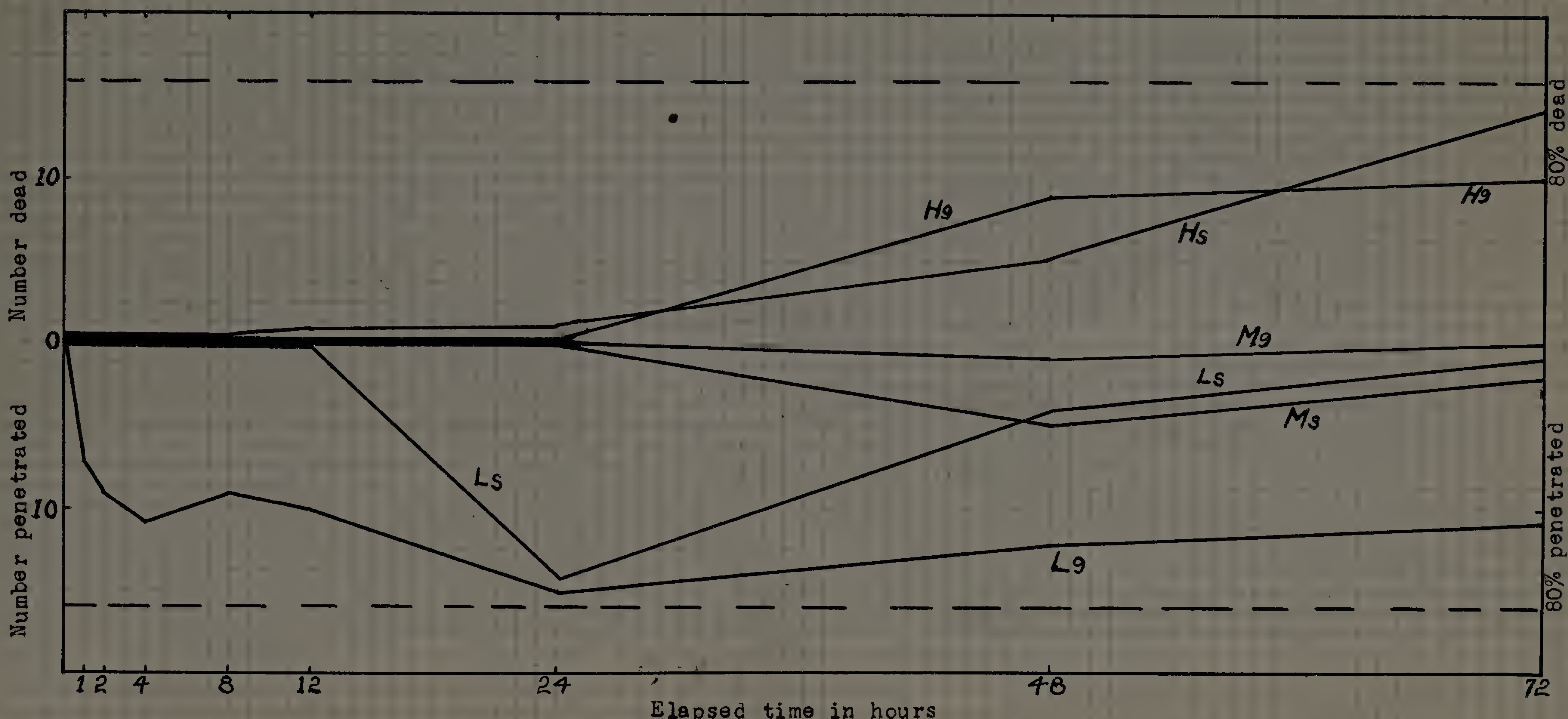
Elapsed time in hours.

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	5	0	5	14	0	14
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	9	10	0	10
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	-1	3	3	0
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	-5	1	3	-2
Ls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	-14	4	8	-4	7	8	-1
L9	0	7	-7	0	9	-9	0	11	-11	0	9	-9	0	10	-10	0	15	-15	2	14	-12	2	13	-11

RICHMOND GRAPH I-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with orthodichlorobenzene.

Based on arbitrary scores contained in RICHMOND TABLE I-O
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



RICHMOND TABLE II-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with paradichlorobenzene.

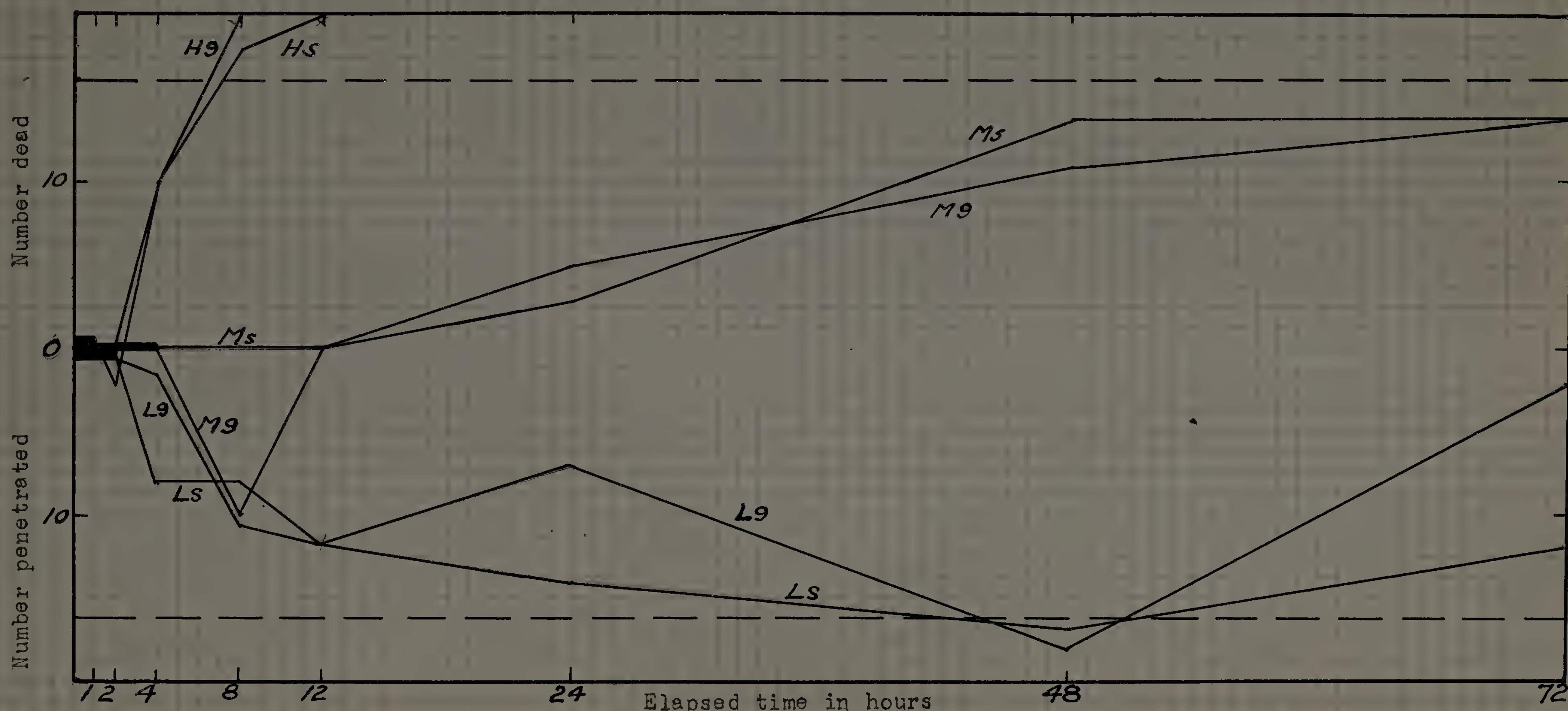
Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil No.	Elapsed time in hours. 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	10	0	10	18	0	18	20	0	20									
H9	0	0	0	0	-2	-2	10	0	10	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	14	0	14	14	0	14
M9	0	0	0	0	0	0	0	0	0	0	10	-10	0	0	0	5	0	5	11	0	11	14	0	14
Ls	0	0	0	0	0	0	0	8	-8	0	8	-8	0	12	-12	0	14	-14	1	18	-17	1	13	-12
L9	0	0	0	0	0	0	0	2	-2	0	11	-11	0	12	-12	0	7	-7	1	19	-18	6	8	-2

RICHMOND GRAPH II-C

Toxic action to termites of soil from Richmond, Va., immediately after treatment with paradichlorobenzene.

Based on arbitrary scores contained in RICHMOND TABLE II-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



RICHMOND TABLE III-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with beta naphthol.

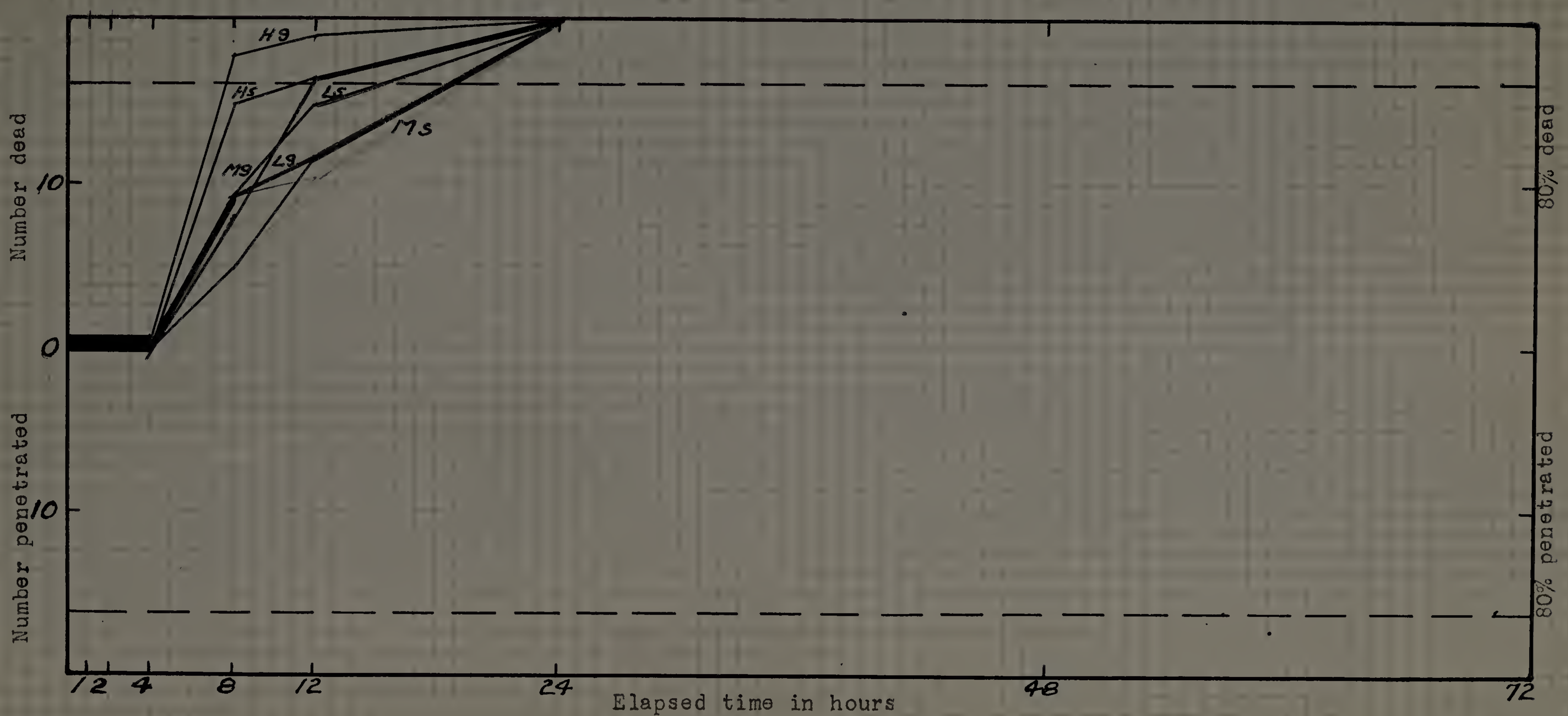
Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	15	0	15	17	0	17	20	0	20						
H9	0	0	0	0	0	0	0	0	0	18	0	18	19	0	19	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	5	0	5	12	0	12	20	0	20						
M9	0	0	0	0	0	0	0	0	0	8	0	8	17	0	17	20	0	20						
Ls	0	0	0	0	0	0	0	0	0	9	0	9	15	0	15	20	0	20						
L9	0	0	0	0	0	0	0	0	0	9	0	9	12	0	12	20	0	20						

RICHMOND GRAPH III-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with beta naphthol.

Based on arbitrary scores contained in RICHMOND TABLE III-O.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



RICHMOND TABLE IV-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9".

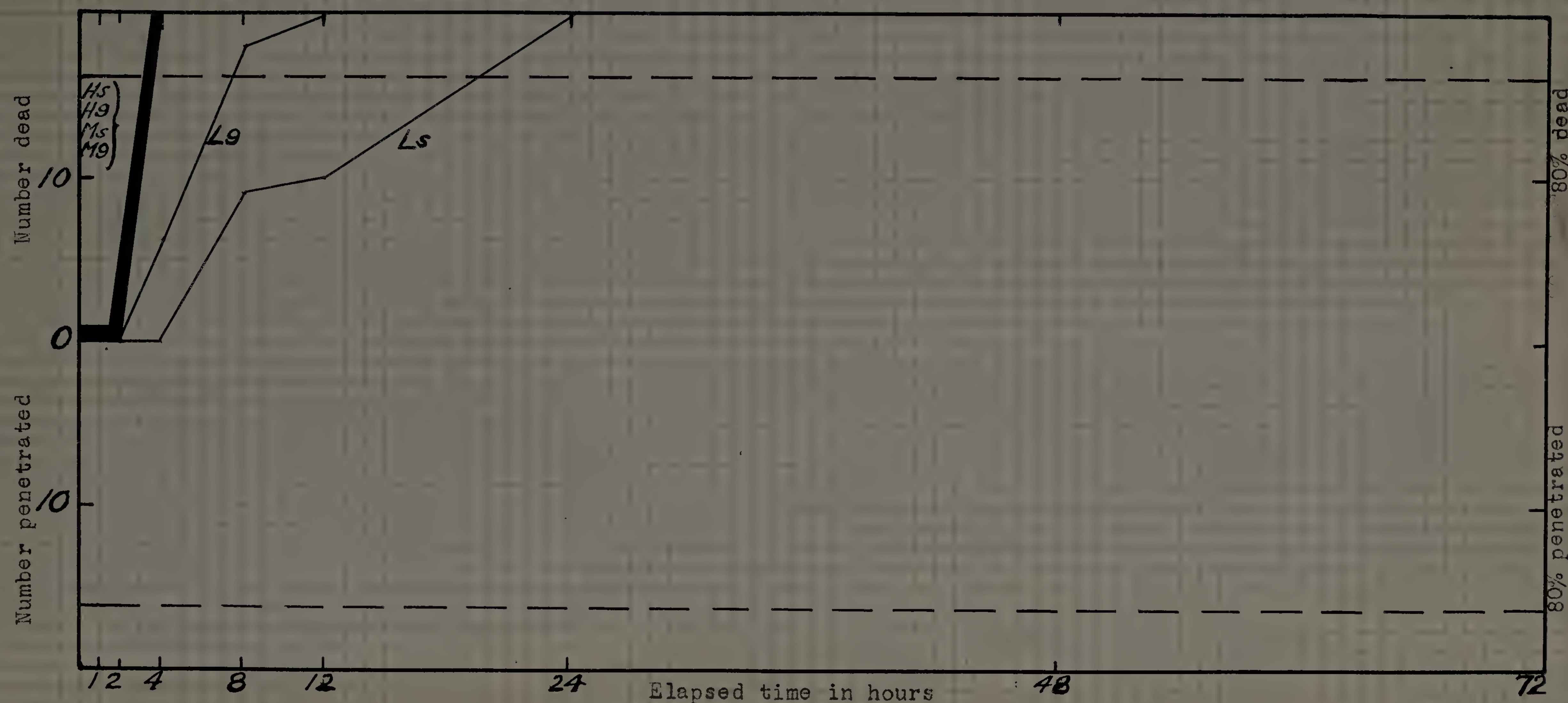
Elapsed time in hours.

Soil	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	20	0	20															
H9	0	0	0	0	0	0	20	0	20															
Ms	0	0	0	0	0	0	20	0	20															
M9	0	0	0	0	0	0	20	0	20															
Ls	0	0	0	0	0	0	0	0	0	9	0	9	10	0	10	20	0	20						
L9	0	0	0	0	0	0	6	0	6	18	0	18	20	0	20									

RICHMOND GRAPH IV-C

Toxic action to termites of soil from Richmond, Va., immediately after treatment with pentachlorophenol.

Based on arbitrary scores contained in RICHMOND TABLE IV-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



RICHMOND TABLE V-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with white arsenic.

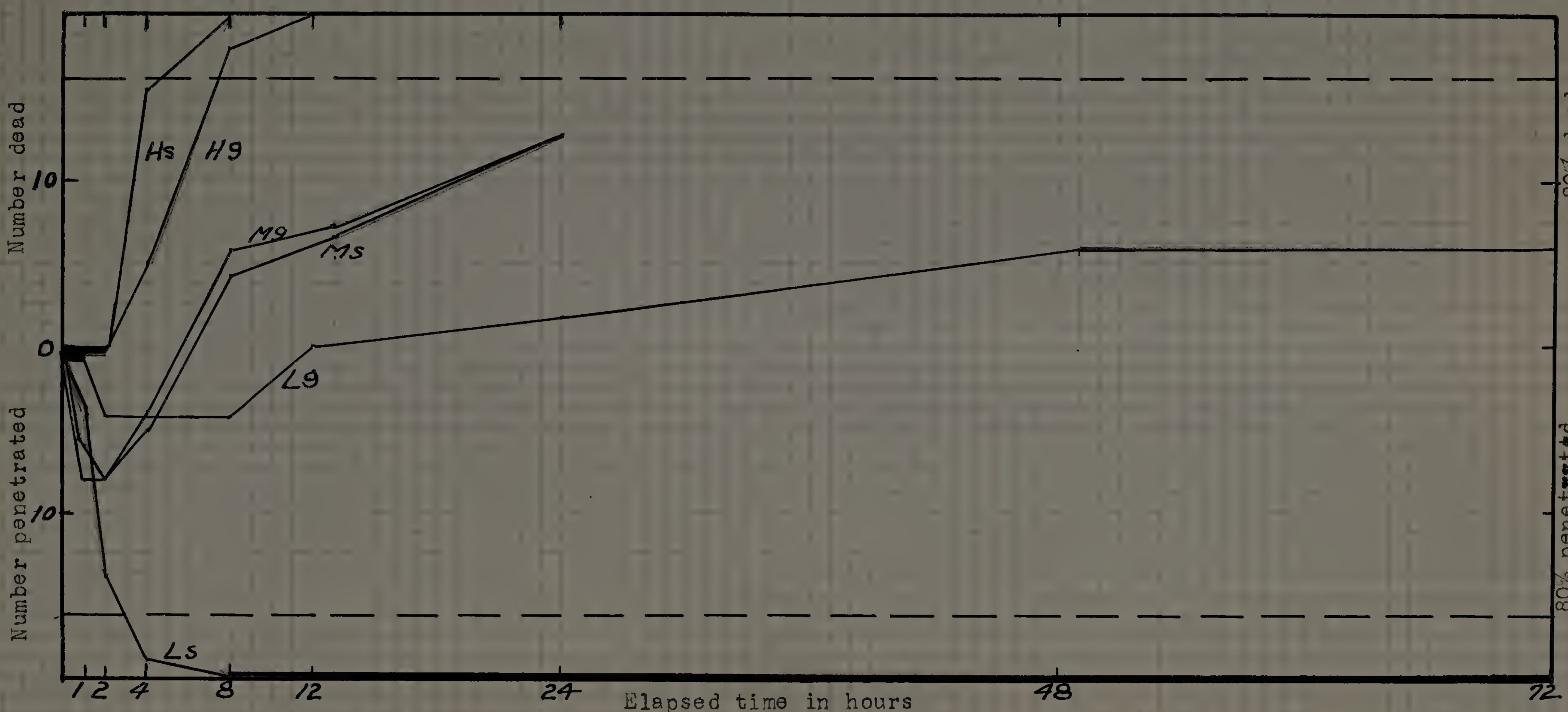
Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	16	0	16	20	0	20												
H9	0	0	0	0	0	0	5	0	5	18	0	18	20	0	20									
Ms	0	6	-6	0	8	-8	2	7	-5	11	7	4	14	7	7	20	7	13						
M9	0	8	-8	0	8	-8	0	9	-9	13	7	6	14	7	7	20	7	13						
Ls	0	4	-4	0	14	-14	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	4	-4	0	4	-4	2	6	-4	7	7	0	7	5	2	12	6	6	12	6	6

RICHMOND GRAPH V-O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with white arsenic.

Based on arbitrary scores contained in RICHMOND TABLE V-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".



RICHMOND TABLE O

Toxic action to termites of soil from Richmond, Va., immediately after treatment with various chemicals.
(Based on RICHMOND TABLES I-O, II-O, III-O, IV-O and V-O.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale): 1 2 4 8 12 — 24 — 48 — 72
	Orthodichlorobenzene
Hs	---(14 dead)
H9	---(10 dead)
Ms	---(3 dead)
M9	---(1 dead)
Ls	---(7 dead)
L9	---(2 dead)
	Paradichlorobenzene
Hs	--------x
H9	--------x
Ms	---(14 dead)
M9	---(14 dead)
Ls	---(1 dead)
L9	---(6 dead)
	Beta naphthol
Hs	--------x
H9	--------x
Ms	------------x
M9	------------x
Ls	------------x
L9	------------x
	Pentachlorophenol
Hs	----x
H9	----x
Ms	----x
M9	----x
Ls	-----------------------x
L9	--------x
	White arsenic
Hs	----x
H9	--------x
Ms	------------x
M9	------------x
Ls	---(0 dead)
L9	---(12 dead)

Discussion of Section 2

Results of tests on toxicity of soil from Richmond, Virginia immediately after treatment with various chemicals.
(Based on Richmond Tables I-O ---- V-O)

Orthodichlorobenzene: Very poor kills. None of the samples were sufficiently toxic to kill 80% of the termites during the course of the tests.

Paradichlorobenzene: Very poor kills. Only samples having a high concentration of paradichlorobenzene were sufficiently toxic to kill 80% of the termites.

Beta Naphthol: All samples very toxic. 80% kill obtained in 12 hours or less.

Pentachlorophenol: All samples very toxic. 80% kill obtained with 6 of the 8 samples in 4 hours or less.

White arsenic: Samples having high and medium concentrations very toxic. Low kills with samples having low concentrations.

SECTION 3

AMHERST (WD)* TABLE I-O

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of sample shown by s, surface; 9, 9".
(WD)*....Well drained

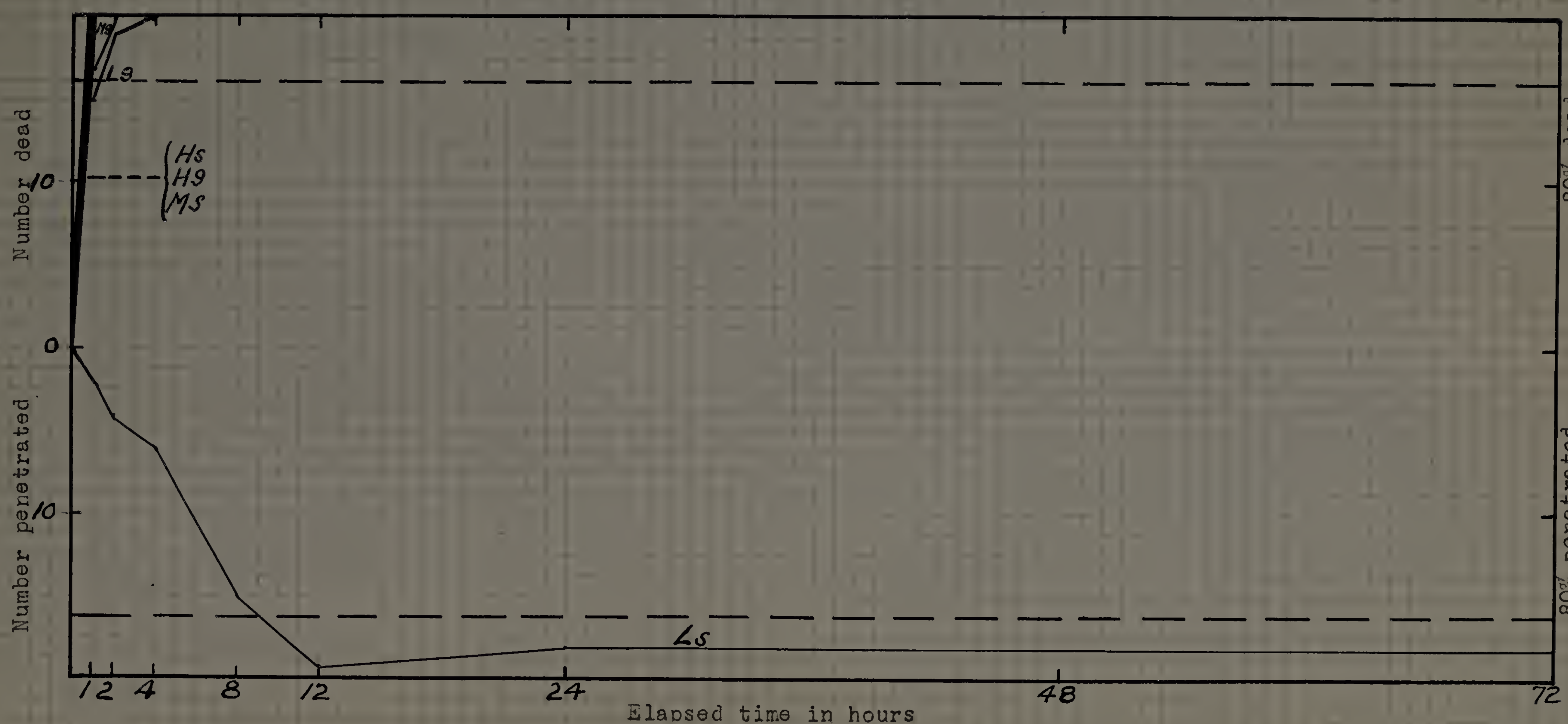
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	20	0	20																					
H9	20	0	20																					
Ms	20	0	20																					
M9	17	0	17	20	0	20																		
Ls	0	2	-2	0	4	-4	0	6	-6	0	15	-15	0	19	-19	0	18	-18	0	18	-18	0	18	-18
L9	15	0	15	19	0	19	20	0	20															

AMHERST (WD) GRAPH I-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with orthodichlorobenzene.

Based on arbitrary scores contained in AMHERST (WD) TABLE I-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

WD* -- (Well drained)



AMHERST (WD)* TABLE II-O

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(WD)*....Well drained

Elapsed time in hours

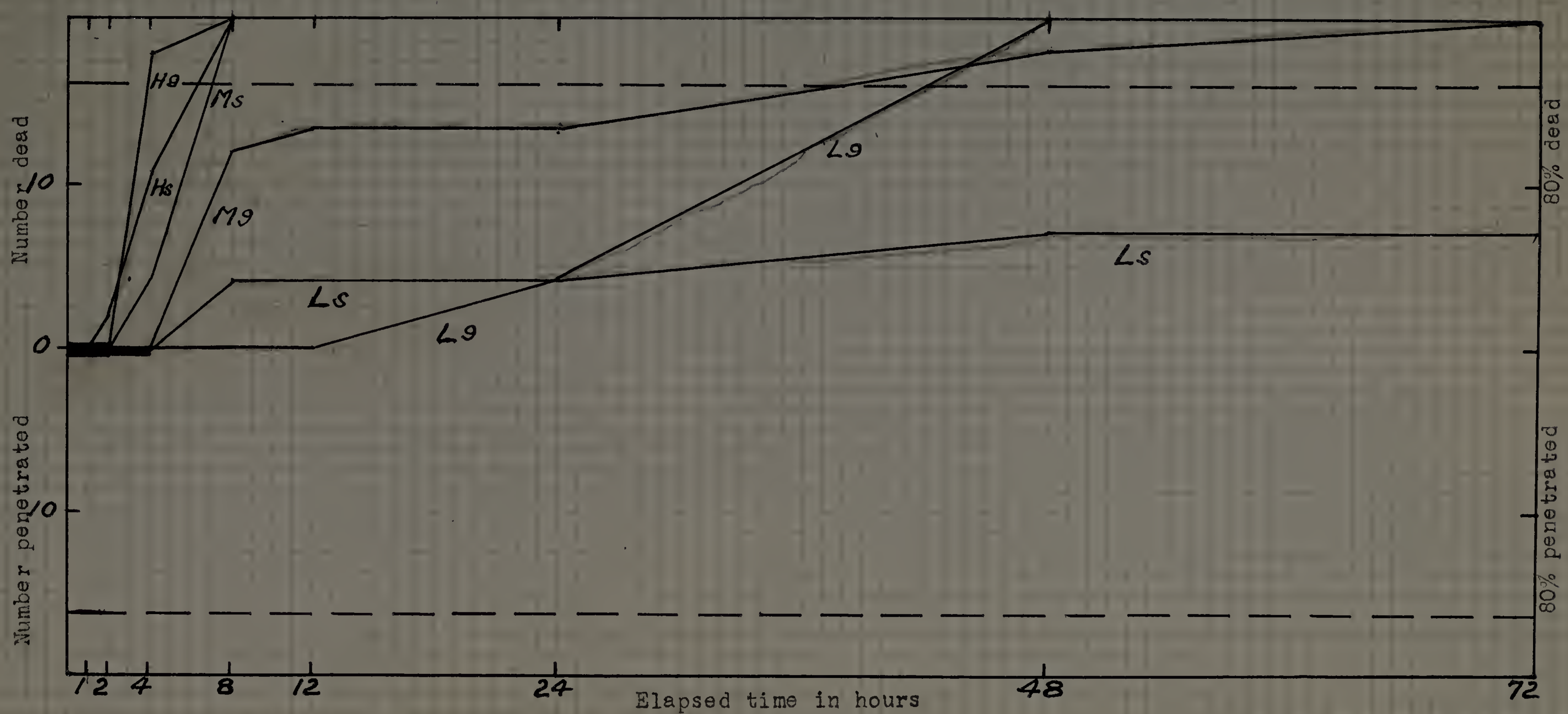
Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	2	0	2	11	0	11	20	0	20												
H9	0	0	0	0	0	0	18	0	18	20	0	20												
Ms	0	0	0	0	0	0	4	0	4	20	0	20												
M9	0	0	0	0	0	0	0	0	0	12	0	12	13	0	13	13	0	13	18	0	18	20	0	20
Ls	0	0	0	0	0	0	0	0	0	4	0	4	4	0	4	4	0	4	7	0	7	7	0	7
L9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20			

AMHERST (WD) GRAPH II-O

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with paradichlorobenzene.

Based on arbitrary scores contained in AMHERST (WD) TABLE II-O.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

WD* -- (Well drained)



AMHERST (WD)* TABLE III-O

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(WD)*....Well drained

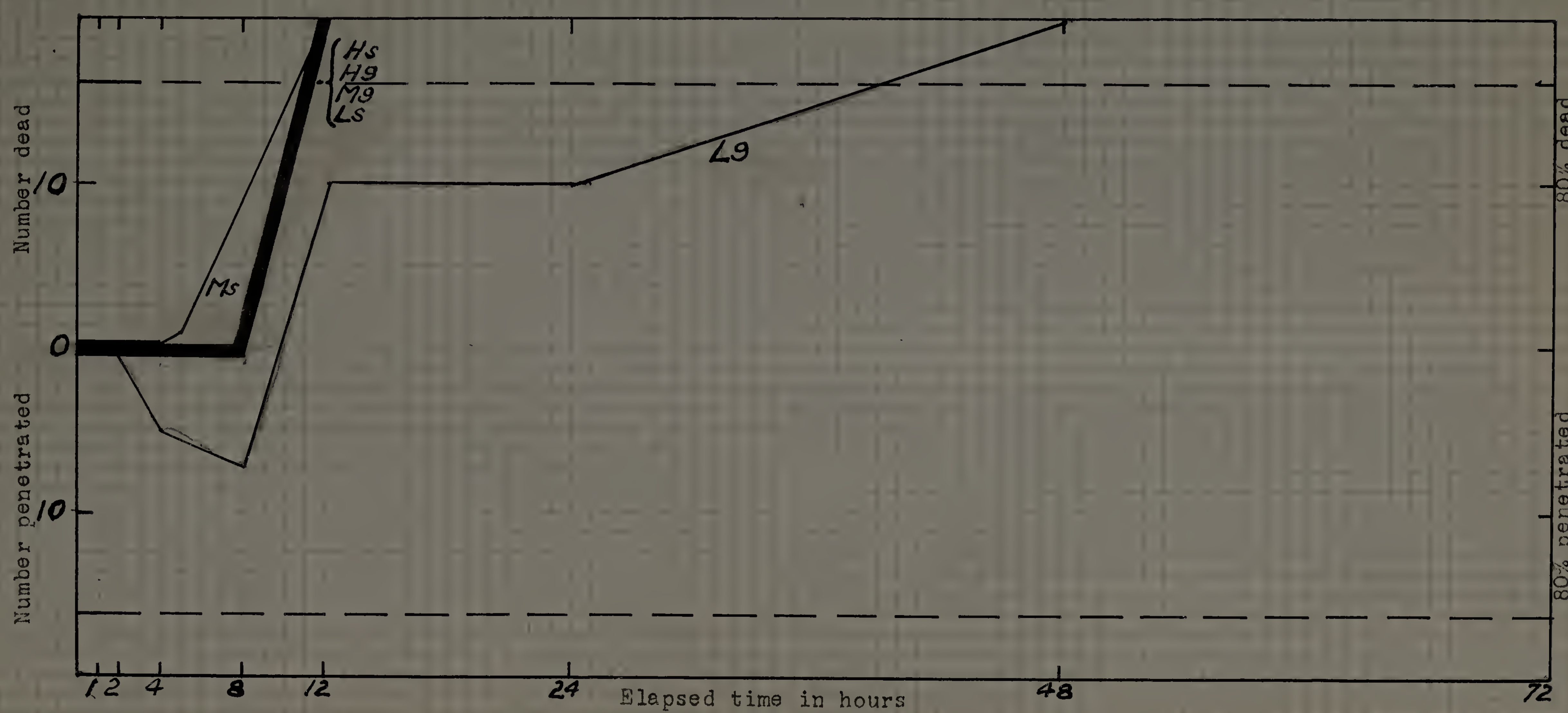
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20									
H9	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20									
Ms	0	0	0	0	0	0	0	0	0	1	0	1	20	0	20									
M9	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20									
Ls	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20									
L9	0	0	0	0	0	0	0	5	-5	0	7	-7	10	0	10	10	0	10	20	0	20			

AMHERST (WD)*GRAPH III-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with beta-naphthol.

Based on arbitrary scores contained in AMHERST (WD) TABLE III-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

WD* -- (Well drained)



AMHERST (WD)* TABLE IV-O

Toxic action to termites of soil (WD)* from Amherst, Mass., immediately after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(WD)*....Well drained

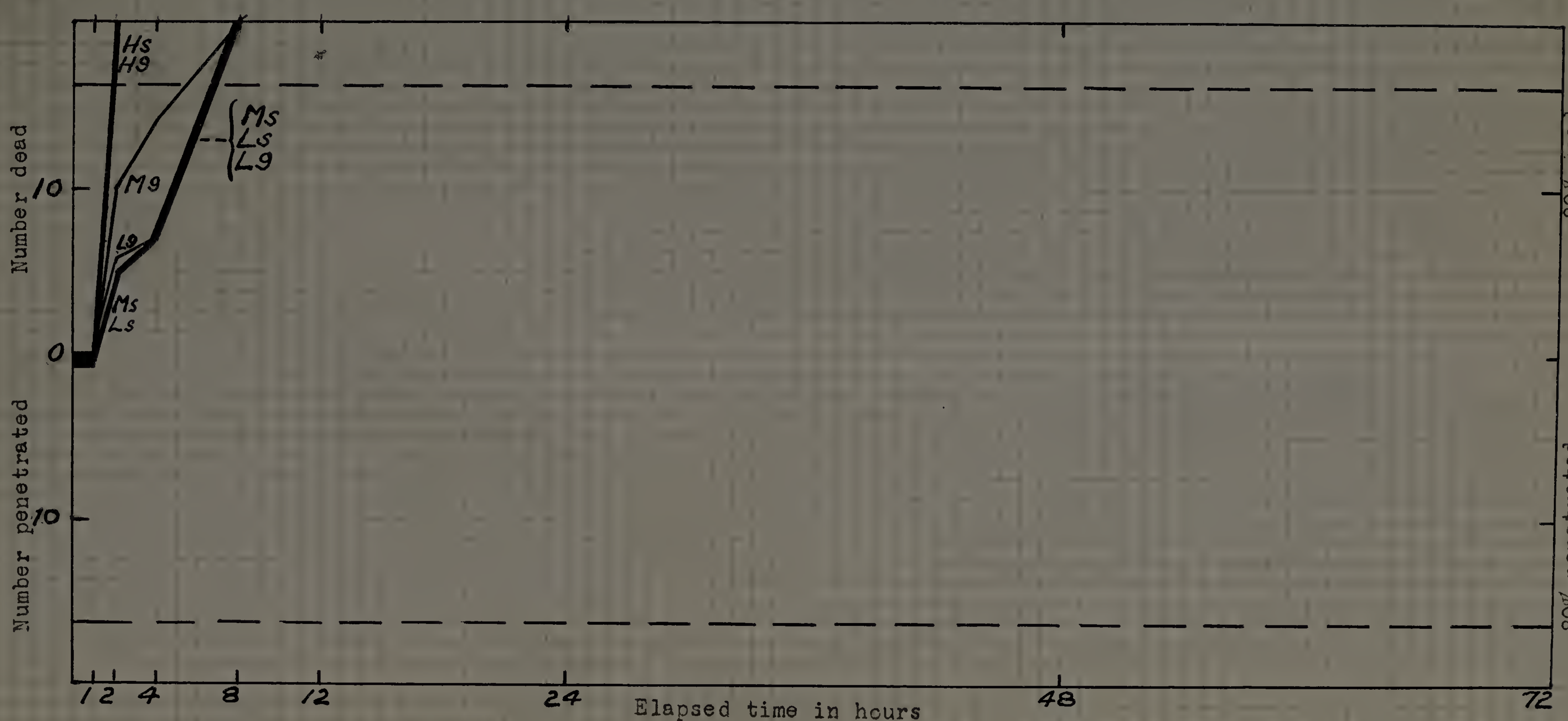
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	20	0	20																		
H9	0	0	0	20	0	20																		
Ms	0	0	0	5	0	5	7	0	7	20	0	20												
M9	0	0	0	10	0	10	14	0	14	20	0	20												
Ls	0	0	0	5	0	5	7	0	7	20	0	20												
L9	0	0	0	6	0	6	7	0	7	20	0	20												

AMHERST (WD) GRAPH IV-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with pentachlorophenol.

Based on arbitrary scores contained in AMHERST (WD) TABLE IV-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

WD* -- (Well drained)



AMHERST (WD)* TABLE V-O

Toxic action to termites of soil (WD)* from Amherst, Mass., immediately after treatment with white arsenic.

Two tests, each using ten termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(WD)*....Well drained

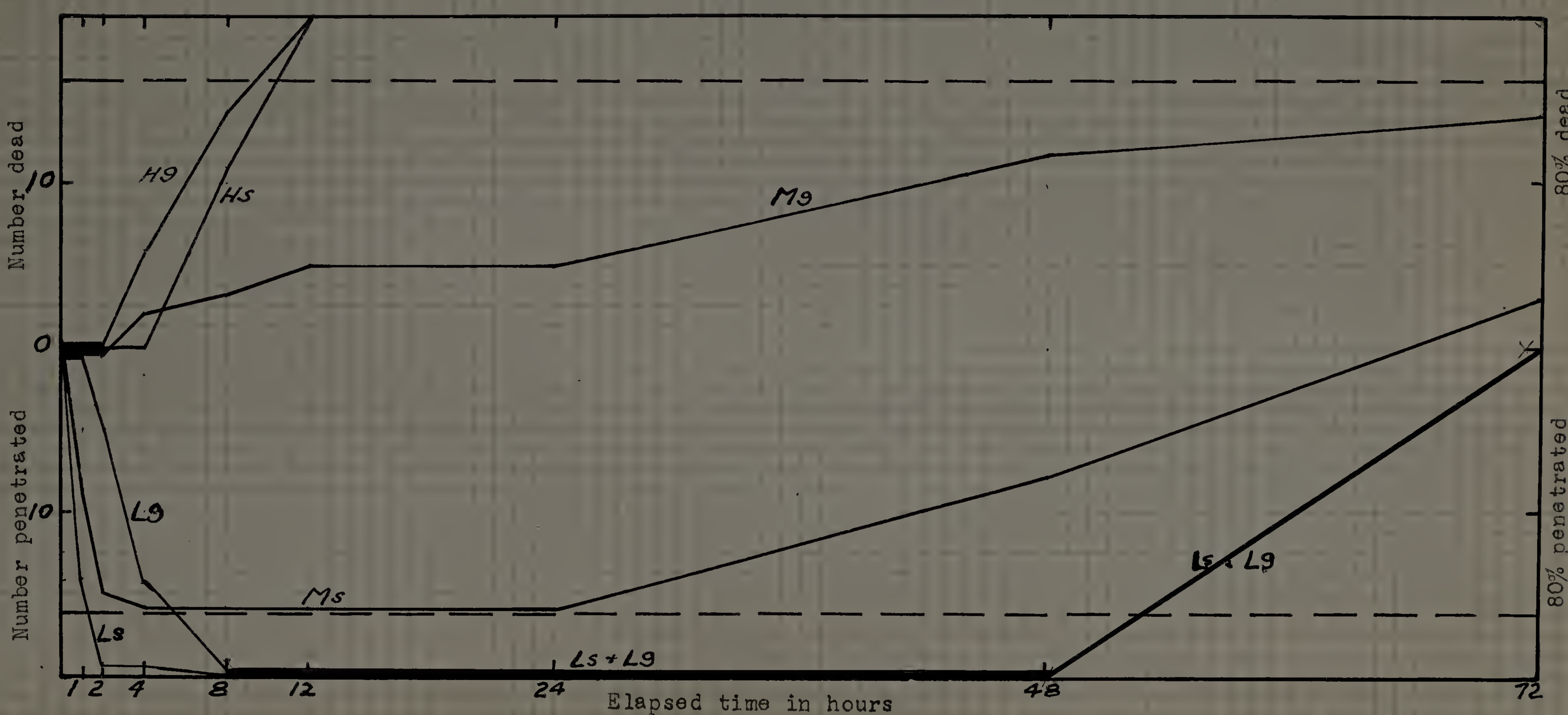
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	11	0	11	20	0	20									
H9	0	0	0	0	0	0	6	0	6	14	0	14	20	0	20									
Ms	0	9	-9	0	15	-15	0	16	-16	2	18	-16	2	18	-16	2	18	-16	9	17	-8	20	17	3
M9	0	0	0	0	0	0	2	0	2	11	8	3	11	6	5	11	6	5	18	6	12	20	6	14
Ls	0	14	-14	0	19	-19	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	20	0
L9	0	0	0	0	5	-5	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	20	0

AMHERST (WD) GRAPH V-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with white arsenic.

Based on arbitrary scores contained in AMHERST (WD) TABLE V-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

WD* -- (Well drained)



AMHERST (WD)* TABLE 0

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-0, II-0, III-0, IV-0 and V-0.)
Length of time necessary for approximately 80% kill indicated under the approprâate hour mark.
(WD)*....Well drained

Soil No.	Elapsed time in hours (to scale) 1	2	4	8	12	24	48	72
					Orthodichlorobenzene			
Hs	x							
H9	x							
Ms	x							
M9	x							
Ls								(0 dead)
L9	x							
					Paradichlorobenzene			
Hs				X				
H9			X					
Ms				X				
M9							X	
Ls								(7 dead)
L9							X	
					Beta naphthol			
Hs					X			
H9					X			
Ms					X			
M9					X			
Ls					X			
L9							X	
					Pentachlorophenol			
Hs		X						
H9		X						
Ms				X				
M9			X					
Ls				X				
L9				X				
					White arsenic			
Hs					X			
H9				X				
Ms								X
M9							X	
Ls								X
L9								X

Discussion of Section 3

Results of tests on the toxicity of soil from Amherst, Mass. (Well drained) immediately after treatment with various chemicals.
(Based on Amherst (WD) Tables I-O ---- V-O)

Orthodichlorobenzene: Very rapid kills on all samples. 80% kill in 4 hours or less with all but one sample.

Paradichlorobenzene: Good kills with 3 of the samples (80% kill in 8 hours or less) Fair kills with remaining samples.

Beta Naphthol: Very good kills. 80% dead in 7 samples out of 8 in 12 hours or less.

Pentachlorophenol: Very good kills. 80% kill in all samples in 8 hours or less.

White arsenic: Good kills with two samples (high concentration); poor kills on other 4 samples.

SECTION 4

AMHERST (PD)* TABLE I-O

Toxic action to termites of soil (PD)* from Amherst, Mass., immediately after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(PD)*....Poorly drained

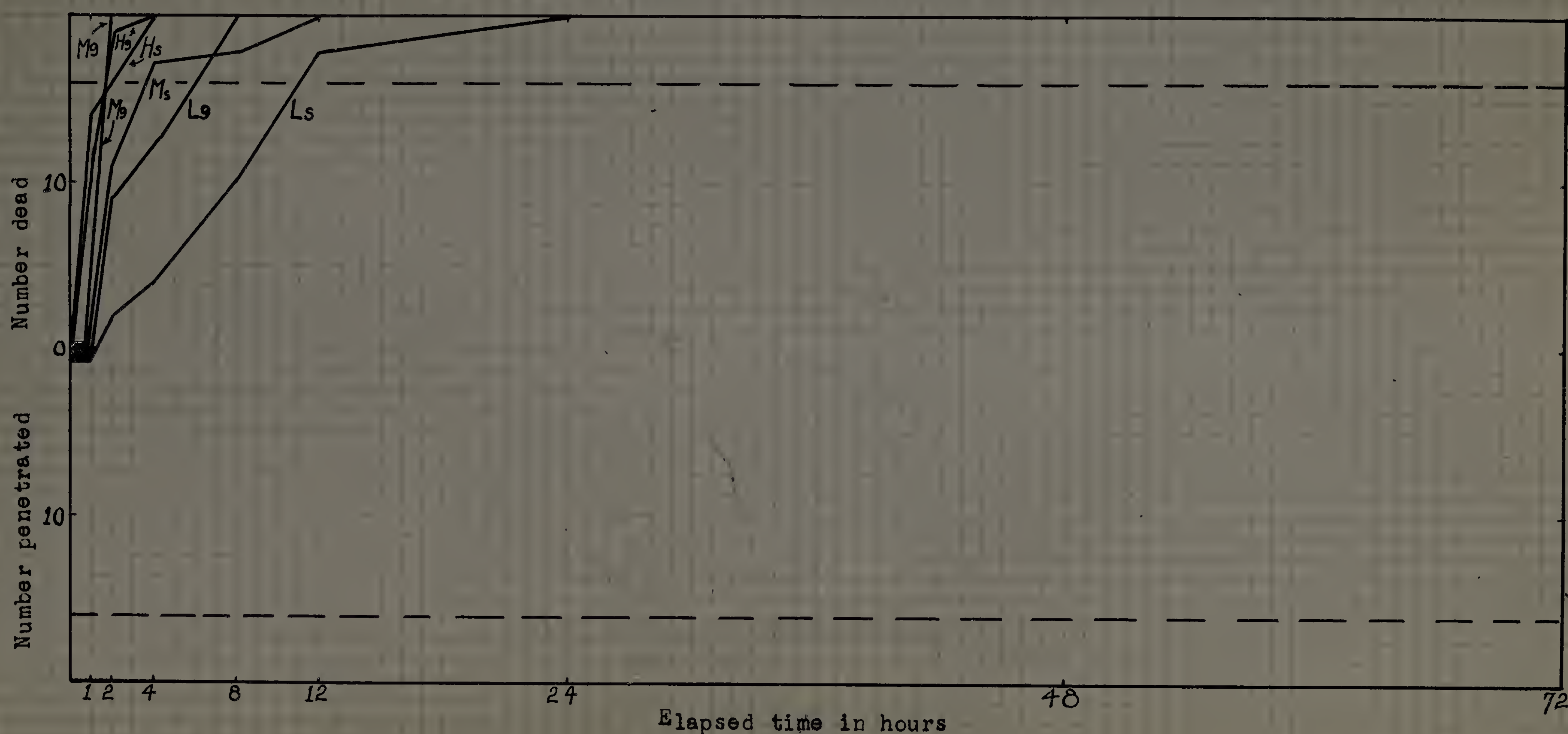
Elapsed time in hours

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	14	0	14	16	0	16	20	0	20															
H9	12	0	12	19	0	19	20	0	20															
Ms	0	0	0	11	0	11	17	0	17	18	0	18	20	0	20									
M9	0	0	0	20	0	20																		
Ls	0	0	0	2	0	2	4	0	4	10	0	10	18	0	18	20	0	20						
L9	0	0	0	9	0	9	12	0	12	20	0	20												

AMHERST (PD)* GRAPH I-O

Toxic action to termites of soil from Amherst,(PD)*, Mass., immediately after treatment with orthodichlorobenzene.

Based on arbitrary scores contained in AMHERST (PD)*
TABLE I-O
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(PD)*...Poorly drained



AMHERST (PD)* TABLE II-O

Toxic action to termites of soil (PD)* from Amherst, Mass., immediately after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(PD)*....Poorly drained

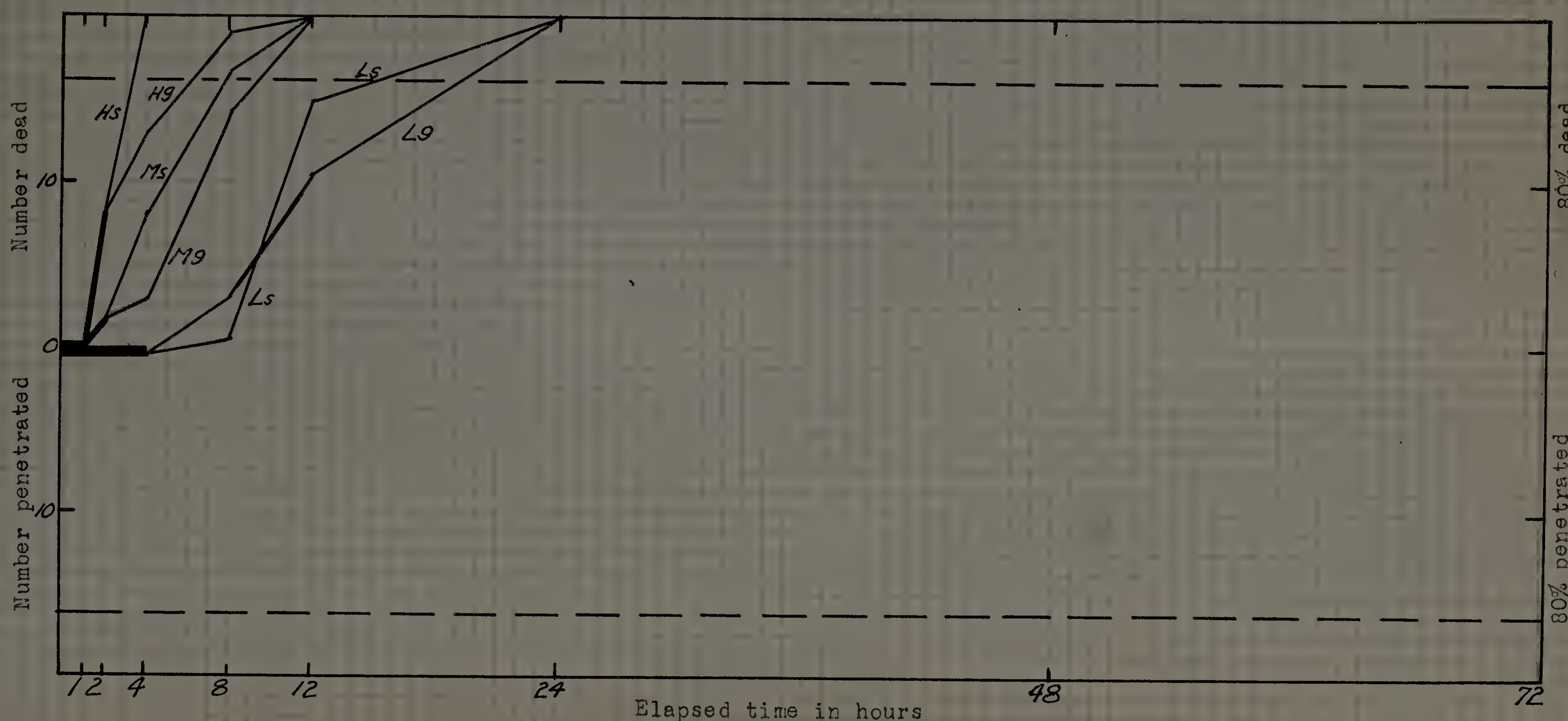
Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	8	0	8	20	0	20															
H9	0	0	0	8	0	8	13	0	13	19	0	19	20	0	20									
Ms	0	0	0	2	0	2	8	0	8	17	0	17	20	0	20									
M9	0	0	0	2	0	2	3	0	3	14	0	14	20	0	20									
Ls	0	0	0	0	0	0	0	0	0	1	0	1	15	0	15	20	0	20						
L9	0	0	0	0	0	0	0	0	0	3	0	3	11	0	11	20	0	20						

AMHERST (PD) GRAPH II-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with paradichlorobenzene.

Based on arbitrary scores contained in AMHERST (PD) TABLE II-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

PD* -- (Poorly drained)



AMHERST (PD)* TABLE III-O

Toxic action to termites of soil (PD)* from Amherst, Mass., immediately after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(PD)*....Poorly drained

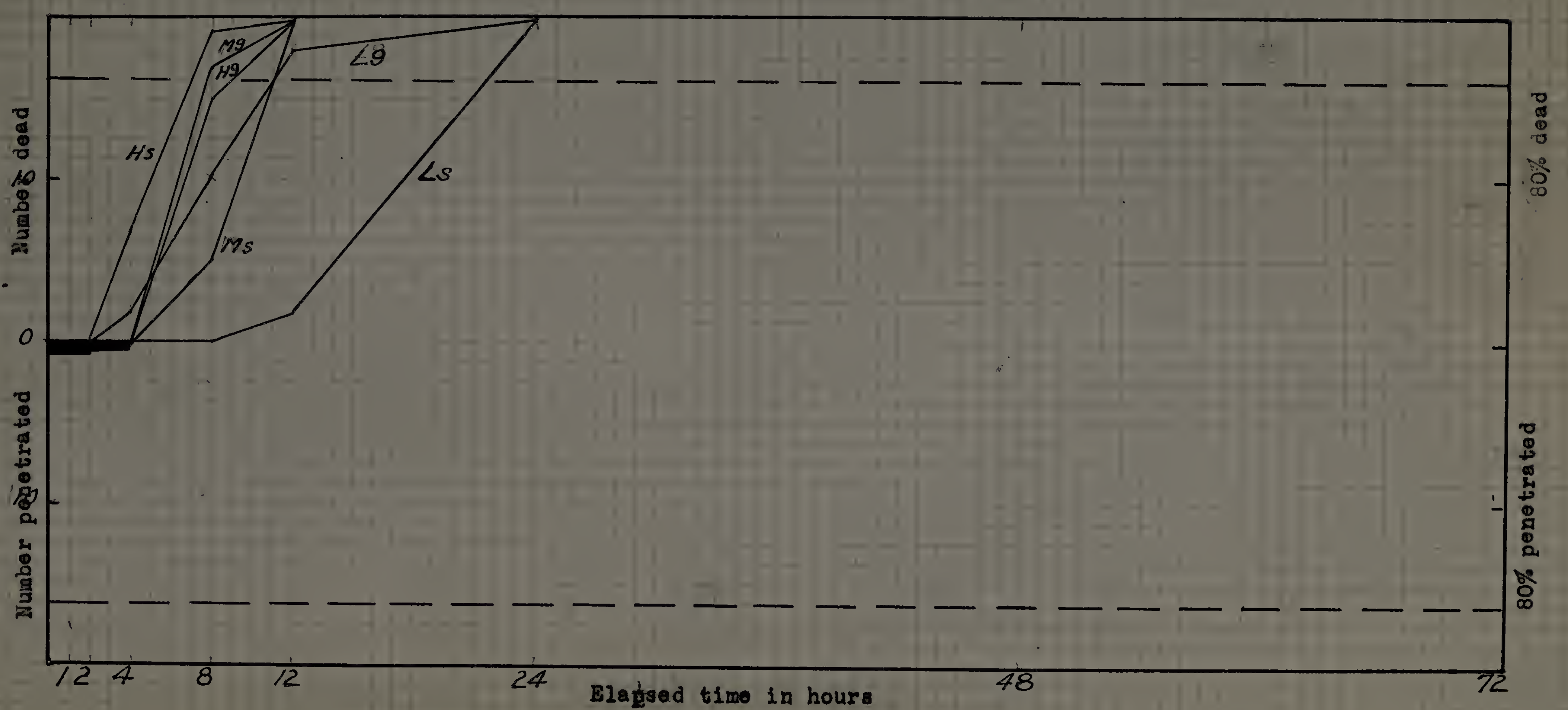
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	7	0	7	19	0	19	20	0	20									
H9	0	0	0	0	0	0	0	0	0	15	0	15	20	0	20									
Ms	0	0	0	0	0	0	0	0	0	5	0	5	20	0	20									
M9	0	0	0	0	0	0	0	0	0	17	0	17	20	0	20									
Ls	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	20	0	20						
L9	0	0	0	0	0	0	2	0	2	10	0	10	18	0	18	20	0	20						

AMHERST (PD) GRAPH III-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with beta naphthol.

Based on arbitrary scores contained in AMHERST (PD) TABLE III-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

PD* -- (Poorly drained)



AMHERST (PD)* TABLE IV-O

Toxic action to termites of soil (PD)* from Amherst, Mass., immediately after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(PD)*....Poorly drained

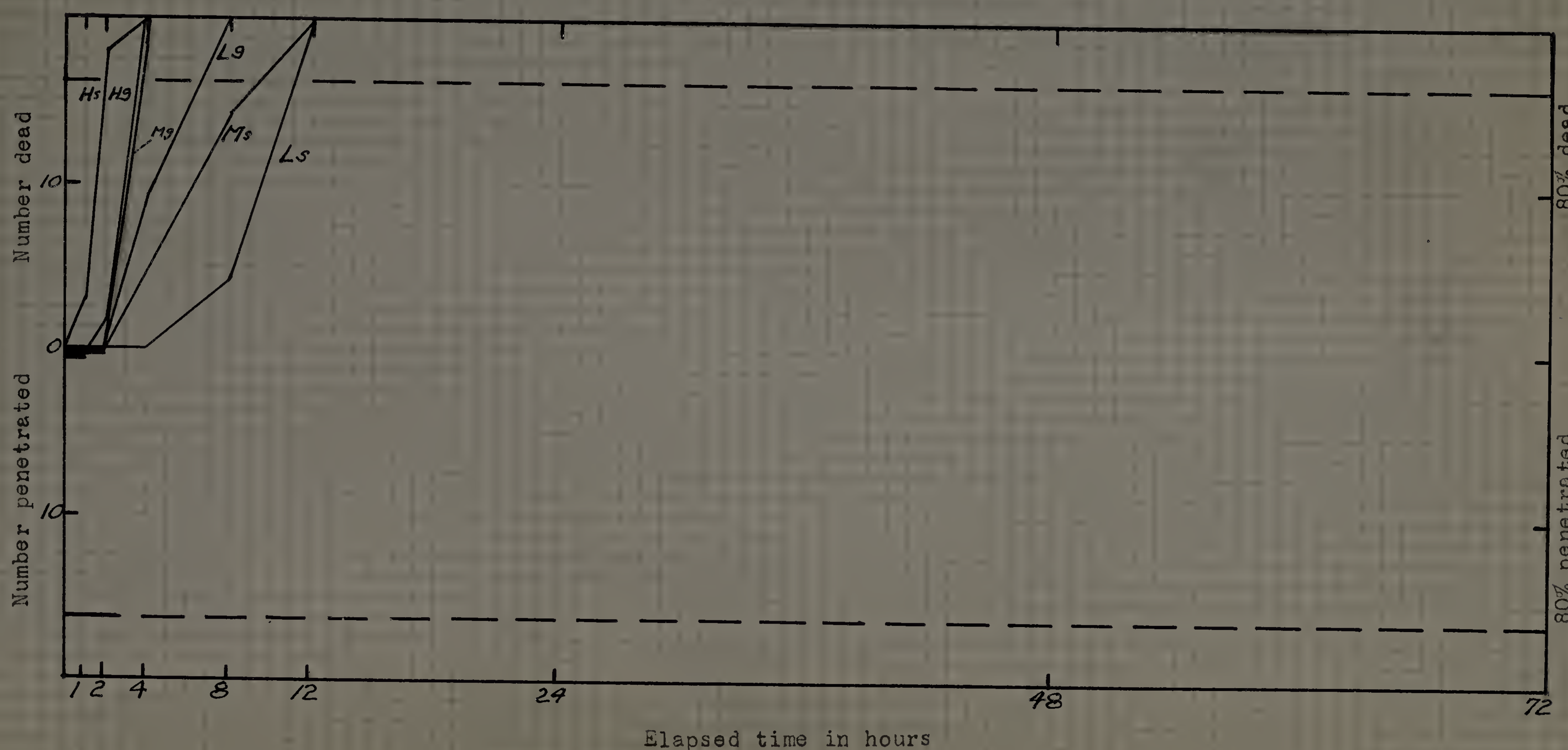
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	3	0	3	18	0	18	20	0	20															
H9	0	0	0	2	0	2	20	0	20															
Ms	0	0	0	0	0	0	4	0	4	14	0	14	20	0	20									
M9	0	0	0	0	0	0	20	0	20															
Ls	0	0	0	0	0	0	0	0	0	5	0	5	20	0	20									
L9	0	0	0	0	0	0	9	0	9	20	0	20												

AMHERST (PD) GRAPH IV-C

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with pentachlorophenol.

Based on arbitrary scores contained in AMHERST (PD) TABLE IV-C.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

PD* -- (Poorly drained)



AMHERST (PD)* TABLE V-O

Toxic action to termites of soil (PD)* from Amherst, Mass., immediately after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".
(PD)*....Poorly drained

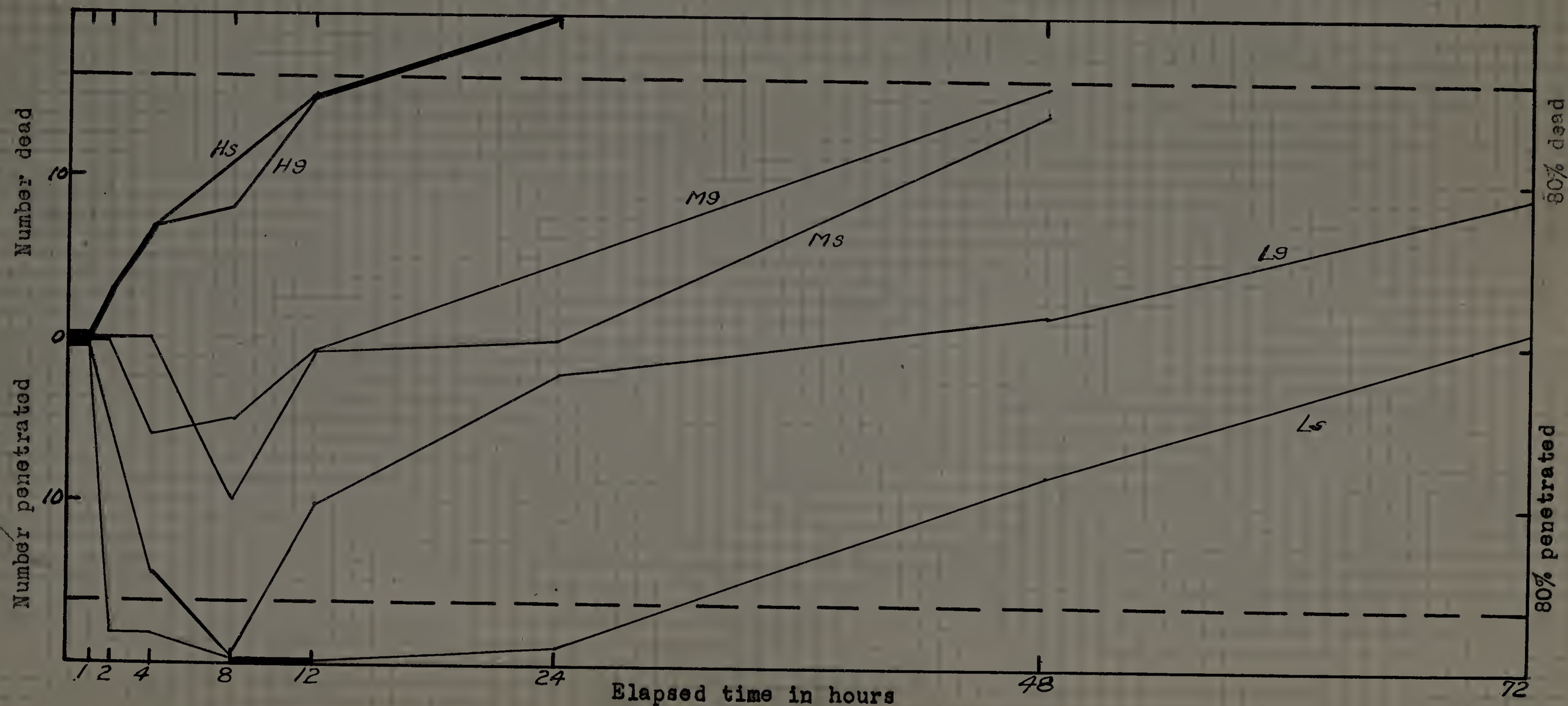
Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	3	0	3	7	0	7	11	0	11	15	0	15	20	0	20						
H9	0	0	0	3	0	3	7	0	7	8	0	8	15	0	15	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	0	10	-10	6	7	-1	6	6	0	20	6	14			
M9	0	0	0	0	0	0	0	6	-6	0	5	-5	6	7	-1	12	7	5	20	4	16			
Ls	0	0	0	0	18	-18	0	18	-18	0	20	-20	0	20	-20	0	19	-19	11	19	-8	20	19	1
L9	0	0	0	0	6	-6	0	15	-15	0	20	-20	3	13	-10	6	8	-2	13	11	2	20	11	9

AMHERST (PD) GRAPH V-O

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with white arsenic.

Based on arbitrary scores contained in AMHERST (PD) TABLE V-O.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9".

PD* -- (Poorly drained)



AMHERST (PD)* TABLE 0

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with various chemicals.
(Based On AMHERST (PD)* TABLES I-0, II-0, III-0, IV-0 and V-0.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)*....Poorly drained

Soil No.	Elapsed time in hours (to scale): 1 2 4 8 12 24 48 72
	Orthodichlorobenzene
Hs	--X
H9	--X
Ms	----X
M9	--X
Ls	------------X
L9	----X
	Paradichlorobenzene
Hs	----X
H9	----X
Ms	--------X
M9	--------X
Ls	------------X
L9	-----------------------X
	Beta naphthol
Hs	--------X
H9	--------X
Ms	------------X
M9	--------X
Ls	-----------------------X
L9	------------X
	Pentachlorophenol
Hs	--X
H9	----X
Ms	--------X
M9	----X
Ls	------------X
L9	--------X
	White arsenic
Hs	------------X
H9	------------X
Ms	--X
M9	-----------------------X
Ls	---X
L9	--X

Discussion of Section 4

Results of tests on toxicity of soil from Amherst, Mass. (poorly drained) immediately after treatment with various chemicals.
(Based on Amherst (PD) Tables I-O ---- V-O)

Orthodichlorobenzene: Very good kills. 80% kill in all samples in 12 hours or less.

Paradichlorobenzene: Very good kills. 80% kill in all samples in 24 hours or less.

Beta Naphthol: Very good kills. 80% kill in all samples in 24 hours or less.

Pentachlorophenol: Very good kills. 80% kill in all samples in 12 hours or less.

White arsenic: Fair kills. 80% kill at high concentration in 24 hours, at medium concentration in 48 hours, and at low concentration in 72 hours.

Discussion of results of tests on the initial toxicity of the various chemicals.

(Based on Memphis Tables I-O ---- V-O, Richmond Tables I-O ---- V-O, Amherst (WD) Tables I-O ---- V-O and Amherst (PD) Tables I-O ---- V-O)

Orthodichlorobenzene: This chemical proved to be very effective in all of the soils tested with the exception of that from Richmond, Virginia. Orthodichlorobenzene was most toxic in the soil from Memphis, Tennessee. It should be noted in this connection that the percentage of organic matter is correlated with the effectiveness of orthodichlorobenzene, since very poor results were obtained with the soils from Richmond, having relatively low percentages of organic matter, while very good results were obtained with the soils having a relatively high percentage of organic matter. (See Table XIII for determinations of percentage of organic matter in the various samples.) With this chemical the presence of organic matter increased the effectiveness of the toxicant in question, rather than decreased it as in the case of beta naphthol.

Paradichlorobenzene: This chemical was the least effective of these tested, and acted in a manner similar to orthodichlorobenzene, although it was not as effective as the latter. It will be noted that in general, the poorest results were again obtained with the samples from Richmond, Virginia, and that in almost all cases where a large number of deaths occurred, penetration did not take place, indicating again that the dichlorobenzenes tested act principally as repellents and fumigant poisons. As will be pointed out, in the discussion of white arsenic, stomach poisons do not prevent penetration unless they are present at extremely high concentrations.

Beta Naphthol: This chemical was very effective. In all instances except one, the termites were not able to penetrate the treated soil and in this one instance, penetration was not permanent, hence beta naphthol at the concentrations used should be effective as a soil poison for termites, and should prevent the passage of termites through treated soil, at least immediately after it is applied.

Pentachlorophenol: This poison was very effective in all soils tested at all concentrations. The time necessary to kill was very short, in most cases being slightly less than the time required by beta naphthol and slightly longer than the time required by orthodichlorobenzene. Termites were not able to penetrate any of the samples.

White arsenic: Variable results were obtained with this chemical. In general, the soils containing a very high concentration of chemical (2 lbs. / cu. ft.), were not penetrated, whereas nearly all the other samples were penetrated to a greater or less extent. 100% kill was obtained in practically all cases, however. It should be noted that in many cases, penetration of toxic soil took place in one to two hours, and that deaths resulted without the termites returning to the surface. Hence, white arsenic, at medium and low concentrations has little if any value as a repellent, and functions principally as a stomach poison.

Conclusions

1. Of all the toxicants tested, orthodichlorobenzene gave the quick-results, in the soils where it was effective.

2. Beta naphthol and pentachlorophenol gave excellent results in all soils, although the time required for 80% kill was slightly longer than for orthodichlorobenzene.

3. Paradichlorobenzene gave very poor results, probably because it does not volatilize rapidly enough to build up a concentration of fumes sufficient to kill the termites.

4. Orthodichlorobenzene, paradichlorobenzene, beta naphthol and pentachlorophenol, when present in sufficient amounts, will keep termites from penetrating treated soil and will ultimately kill them.

5. White arsenic, although it will not prevent termites from entering treated soil, is very toxic at the concentrations used.

B and C. <u>Tests on the uniformity and permanence of the toxic barriers established with the various chemicals.</u>

Soil samples were obtained from each area at one month, two months, three months and five months after the application of the chemicals. The results of these tests are presented in the following series of tables.

MEMPHIS TABLE I-1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	5	-5	0	8	-8	1	10	-9	2	10	-8	2	18	-16
H9	0	10	-10	0	4	-4	0	7	-7	0	9	-9	0	13	-13	0	15	-15	0	18	-18	0	20	-20
H15	0	0	0	2	0	2	2	2	0	2	0	2	2	0	2	6	0	6	9	0	9	9	0	9
Ms	0	0	0	0	0	0	0	6	-6	0	9	-9	0	13	-13	1	17	-16	1	17	-16	7	10	-3
M9	0	2	-2	0	4	-4	0	4	-4	0	5	-5	0	5	-5	0	8	-8	0	18	-18	0	20	-20
M15	0	2	-2	0	4	-4	0	2	-2	0	8	-8	0	9	-9	0	18	-18	0	17	-17	0	20	-20
Ls	0	0	0	0	2	-2	0	8	-8	0	7	-7	0	13	-13	1	15	-14	1	17	-16	3	17	-14
L9	0	0	0	12	0	12	18	0	18	19	0	19	20	0	20									
L15	0	0	0	0	2	-2	0	7	-7	0	8	-8	0	10	-10	0	11	-11	4	10	-6	4	19	-15

MEMPHIS TABLE II-1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	5	0	5	5	0	5	10	0	10
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	7	0	7
H15	0	11	-11	0	15	-15	0	4	-4	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	0	0	0	10	-10	0	10	-10	0	10	-10	0	10	-10	0	10	-10	1	15	-14	1	16	-15
M9	0	2	-2	0	13	-13	0	14	-14	0	20	-20	0	20	-20	0	19	-19	0	20	-20	0	20	-20
M15	0	0	0	0	0	0	0	5	-5	0	4	-4	0	2	-2	0	9	-9	0	10	-10	0	20	-20
Ls	0	7	-7	0	13	-13	0	19	-19	0	19	-19	0	20	-20	0	19	-19	0	20	-20	0	20	-20
L9	0	0	0	0	4	-4	0	11	-11	0	11	-11	0	16	-16	0	15	-15	0	18	-18	0	20	-20
L15	0	0	0	0	5	-5	0	12	-12	0	15	-15	0	18	-18	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE III-1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	4	0	4	8	0	8	16	0	16	20	0	20			
H9	0	0	0	0	0	0	0	0	0	2	0	2	6	0	6	16	0	16	20	0	20			
H15	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	17	0	17	20	0	20			
Ms	0	0	0	0	0	0	0	0	0	2	0	2	6	0	6	18	0	18	20	0	20			
M9	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	5	0	5	20	0	20			
M15	0	0	0	0	4	-4	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	8	-8	0	10	-10	0	11	-11	0	12	-12	0	8	-8	1	7	-6	17	7	10
L9	0	9	-9	0	10	-10	0	10	-10	1	10	-9	1	11	-10	6	7	-1	12	8	4	20	8	12
L15	0	5	-5	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE IV-1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	4	0	4	14	0	14	20	0	20												
H9	0	0	0	8	0	8	16	0	16	20	0	20												
H15	0	0	0	0	0	0	0	0	0	4	0	4	11	0	11	20	0	20						
Ms	0	0	0	4	0	4	16	0	16	20	0	20												
M9	0	0	0	0	0	0	2	0	2	8	0	8	8	0	8	18	0	18	20	0	20			
M15	0	0	0	0	0	0	0	2	-2	0	10	-10	0	10	-10	5	10	-5	11	9	2	11	10	1
Ls	0	0	0	0	0	0	0	0	0	12	0	12	18	0	18	20	0	20						
L9	0	0	0	0	3	-3	0	10	-10	0	17	-17	0	18	-18	2	18	-16	2	18	-16	20	16	4
L15	0	5	-5	0	7	-7	0	10	-10	0	14	-14	0	17	-17	0	20	-20	10	19	-9	20	19	1

MEMPHIS TABLE V-1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	6	-6	0	11	-11	0	10	-10	0	10	-10	0	10	-10	7	8	-1	12	8	4
H9	0	0	0	0	2	-2	0	0	0	0	0	0	0	0	0	18	0	18	20	0	20			
H15	0	0	0	0	7	-7	0	16	-16	0	20	-20	0	15	-15	0	17	-17	1	18	-17	2	18	-16
Ms	0	0	0	0	6	-6	0	14	-14	0	17	-17	0	17	-17	0	17	-17	2	18	-16	2	18	-16
M9	0	7	-7	0	8	-8	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	2	-2	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	6	-6	0	17	-17	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	1	-1	0	8	-8	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	3	-3	0	13	-13	0	19	-19	0	18	-18	0	20	-20	0	20	-20	0	14	-14	0	15	-15

MEMPHIS TABLE 1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with various chemicals.
(Based on MEMPHIS TABLES I-1, II-1, III-1, IV-1 and V-1.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale): 1 2 4 8 12 24 48 72
	Orthodichlorobenzene
Hs	--(2 dead)
H9	--(0 dead)
H15	--(9 dead)
Ms	--(7 dead)
M9	--(0 dead)
M15	--(0 dead)
Ls	--(3 dead)
L9	----x
L15	--(4 dead)
	Paradichlorobenzene
Hs	--(10 dead)
H9	--(7 dead)
H15	--(0 dead)
Ms	--(1 dead)
M9	--(0 dead)
M15	--(0 dead)
Ls	--(0 dead)
L9	--(0 dead)
L15	--(0 dead)
	Beta naphthol
Hs	------------------------x
H9	------------------------x
H15	------------------------x
Ms	------------------------x
M9	--x
M15	--(0 dead)
Ls	--x
L9	--x
L15	--(0 dead)
	Pentachlorophenol
Hs	----x
H9	----x
H15	------------------------x
Ms	----x
M9	------------------------x
M15	--(11 dead)
Ls	------------x
L9	--x
L15	--x
	White arsenic
Hs	--(12 dead)
H9	------------------------x
H15	--(2 dead)
Ms	--(2 dead)
M9	--(0 dead)
M15	--(0 dead)
Ls	--(0 dead)
L9	--(0 dead)
L15	--(0 dead)

RICHMOND TABLE I-1

Toxic action to termites of soil from Richmond, Va., one month after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	7	0	7	7	0	7	9	0	9	15	0	15	19	0	19	20	0	20			
H9	0	0	0	13	0	13	15	0	15	20	0	20												
H15	0	0	0	0	0	0	1	4	-3	1	9	-8	1	13	-12	1	15	-14	1	20	-19	1	20	-19
Ms	0	0	0	2	0	2	6	0	6	8	0	8	13	0	13	17	0	17	17	0	17	20	0	20
M9	0	0	0	0	0	0	0	2	-2	1	7	-6	2	8	-6	3	9	-6	3	11	-8	3	11	-8
M15	0	12	-12	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	4	-4	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	3	-3	0	16	-16	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE II-1

Toxic action to termites of soil from Richmond, Va., one month after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	8	-8	0	14	-14	0	15	-15	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	2	0	2	15	0	15	20	0	20									
H15	0	7	-7	0	13	-13	0	9	-9	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	9	-9	0	15	-15	0	20	-20	2	18	-16	2	20	-18	2	20	-18	2	16	-14	4	16	-12
M9	0	0	0	0	0	0	0	0	0	0	5	-5	2	4	-2	2	11	-9	2	20	-18	2	20	-18
M15	0	10	-10	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	17	-17	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	0	0	1	0	1	4	0	4	4	0	4	4	0	4	6	0	6	20	0	20
L15	0	0	0	0	14	-14	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE III-1

Toxic action to termites of soil from Richmond, Va., one month after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	7	0	7	13	0	13	20	0	20						
H9	0	0	0	0	0	0	0	0	0	2	0	2	14	0	14	20	0	20						
H15	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	17	0	17	20	0	20			
Ms	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	20	0	20						
M9	0	0	0	0	0	0	0	0	0	5	0	5	12	0	12	20	0	20						
M15	0	0	0	0	0	0	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	7	-7	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	0	0	0	0	0	4	0	4	15	0	15	20	0	20						
L15	0	2	-2	0	12	-12	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE IV-1

Toxic action to termites of soil from Richmond, Va., one month after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	5	0	5	20	0	20															
H9	0	0	0	0	0	0	19	0	19	20	0	20												
H15	0	0	0	0	0	0	0	0	0	0	10	-10	1	10	-9	10	10	0	10	10	0	10	10	0
Ms	0	0	0	0	0	0	2	0	2	20	0	20												
M9	0	0	0	0	0	0	1	0	1	3	0	3	6	0	6	15	0	15	20	0	20			
M15	0	0	0	0	2	-2	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	2	-2	0	2	-2	1	1	0	4	1	3	12	0	12	20	0	20			
L9	0	0	0	0	7	-7	0	10	-10	0	10	-10	0	10	-10	6	10	-4	10	10	0	10	10	0
L15	0	5	-5	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

Elapsed time in hours (column headings 1–72).

RICHMOND TABLE V-1

Toxic action to termites of soil from Richmond, Va., one month after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	8	-8	1	13	-12	5	14	-9	5	15	-10	5	15	-10	5	15	-10	5	15	-10
H9	0	0	0	0	0	0	6	0	6	14	0	14	20	0	20									
H15	0	0	0	0	0	0	1	0	1	10	0	10	20	0	20									
Ms	0	0	0	0	8	-8	0	20	-20	0	19	-19	0	19	-19	1	19	-18	17	20	-3	20	20	0
M9	0	0	0	0	2	-2	4	6	-2	4	6	-2	20	6	14									
M15	0	0	0	0	3	-3	0	5	-5	6	5	1	9	3	6	17	3	14	20	3	17			
Ls	0	13	-13	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	4	-4	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	5	-5	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE 1

Toxic action to termites of soil from Richmond, Va., one month after treatment with various chemicals.
(Based on RICHMOND TABLES I-1, II-1, III-1, IV-1 and V-1)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale) 1	2	4	8	12	24	48	72
						Orthodichlorobenzene		
Hs					X			
H9			X					
H15								(1 dead)
Ms						X		
M9								(3 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
						Paradichlorobenzene		
Hs								(0 dead)
H9				X				
H15								(0 dead)
Ms								(4 dead)
M9								(2 dead)
M15								(0 dead)
Ls								(0 dead)
L9								X
L15								(0 dead)
						Beta naphthol		
Hs					X			
H9					X			
H15						X		
Ms						X		
M9					X			
M15								(0 dead)
Ls								(0 dead)
L9					X			
L15								(0 dead)
						Pentachlorophenol		
Hs			X					
H9			X					
H15								(10 dead)
Ms				X				
M9						X		
M15								(0 dead)
Ls						X		
L9								(10 dead)
L15								(0 dead)
						White arsenic		
Hs								(5 dead)
H9				X				
H15					X			
Ms							X	
M9					X			
M15						X		
Ls								(0 dead)
L9								(0 dea
L15								(o de

AMHERST (WD)* TABLE I-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	5	-5	0	16	-16	0	18	-18	0	19	-19	0	20	-20	0	20	-20
H9	0	0	0	2	0	2	8	0	8	20	0	20												
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	10	0	10	11	0	11
Ms	0	0	0	0	5	-5	0	6	-6	0	13	-13	0	18	-18	0	18	-18	2	17	-15	2	20	-18
M9	0	0	0	0	0	0	0	0	0	8	0	8	8	0	8	8	0	8	8	0	8	8	0	8
M15	0	0	0	0	0	0	0	5	-5	2	6	-4	2	10	-8	2	10	-8	4	16	-12	4	16	-12
Ls	0	0	0	0	9	-9	0	11	-11	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	12	0	12	17	0	17
L15	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE II-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	2	-2	0	5	-5	0	5	-5	0	4	-4	2	4	-2	6	3	3	14	3	11	17	5	12
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	9	15	0	15	18	0	18
H15	0	0	0	0	3	-3	0	6	-6	0	8	-8	0	8	-8	14	8	6	17	9	8	17	10	7
Ms	0	4	-4	0	10	-10	0	15	-15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	8	0	8	10	0	10
M15	0	0	0	0	11	-11	0	10	-10	0	10	-10	0	16	-16	3	14	-11	3	17	-14	3	17	-14
Ls	0	0	0	0	7	-7	0	0	0	0	7	-7	0	10	-10	15	5	10	16	8	8	19	8	11
L9	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	16	0	16	18	0	18	18	0	18
L15	0	10	-10	0	10	-10	0	10	-10	0	10	-10	0	10	-10	4	10	-6	15	10	5	19	10	9

AMHERST (WD)* TABLE III-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	5	0	5	10	0	10	20	0	20						
H9	0	0	0	0	0	0	0	0	0	7	0	7	14	0	14	20	0	20						
H15	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	12	0	12	20	0	20			
M9	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	18	0	18	20	0	20			
M15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20						
Ls	0	4	-4	0	6	-6	0	11	-11	0	10	-10	0	7	-7	2	7	-5	15	0	15	20	0	20
L9	0	0	0	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	0	0	0	5	-5	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE IV-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	16	0	16	20	0	20															
H9	0	0	0	5	0	5	20	0	20															
H15	0	0	0	4	0	4	16	0	16	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	11	0	11	15	0	15	20	0	20						
M9	0	0	0	0	0	0	0	0	0	5	0	5	10	0	10	20	0	20						
M15	0	0	0	0	0	0	0	0	0	3	0	3	7	0	7	19	0	19	20	0	20			
Ls	0	0	0	0	2	-2	0	0	0	3	0	3	3	0	3	6	0	6	17	0	17	20	0	20
L9	0	0	0	0	1	-1	0	8	-8	0	17	-17	0	17	-17	0	20	-20	9	20	-11	17	20	-3
L15	0	0	0	0	4	-4	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	20	0

AMHERST (WD)* TABLE V-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15"
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	4	-4	0	5	-5	0	10	-10	0	10	-10	0	19	-19	20	20	0			
H9	0	0	0	0	0	0	0	0	0	11	0	11	15	0	15	20	0	20						
H15	0	8	-8	0	8	-8	0	8	-8	4	8	-4	9	8	1	16	7	9	20	0	20			
Ms	0	0	0	0	10	-10	0	10	-10	0	9	-9	0	10	-10	1	10	-9	9	10	-1	9	10	-1
M9	0	0	0	0	8	-8	0	14	-14	1	17	-16	1	19	-18	1	19	-18	5	20	-15	5	20	-15
M15	0	1	-1	0	11	-11	0	19	-19	0	20	-20	0	20	-20	0	20	-20	5	20	-15	5	20	-15
Ls	0	0	0	0	3	-3	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	0	0	0	4	-4	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20
L15	0	5	-5	0	6	-6	0	13	-13	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE 1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-1, II-1, III-1, IV-1 and V-1.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained

Soil No.	Elapsed time in hours (to scale): 1 2 4 8 12 24 48 72
	Orthodichlorobenzene
Hs	--(0 dead)
H9	----------x
H15	--(11 dead)
Ms	--(2 dead)
M9	--(8 dead)
M15	--(4 dead)
Ls	--(0 dead)
L9	---x
L15	--(0 dead)
	Paradichlorobenzene
Hs	---x
H9	---x
H15	---x
Ms	--(0 dead)
M9	--(10 dead)
M15	--(3 dead)
Ls	---x
L9	-----------------------------x
L15	---x
	Beta naphthol
Hs	-----------------------------x
H9	---------------x
H15	-----------------------------x
Ms	-----------------------------x
M9	-----------------------------x
M15	-----------------------------x
Ls	---x
L9	--(0 dead)
L15	--(0 dead)
	Pentachlorophenol
Hs	--x
H9	----x
H15	----x
Ms	---------------x
M9	-----------------------------x
M15	-----------------------------x
Ls	---x
L9	---x
L15	---x
	White arsenic
Hs	---x
H9	---------------x
H15	-----------------------------x
Ms	--(9 dead)
M9	--(5 dead)
M15	--(5 dead)
Ls	--(0 dead)
L9	--(0 dead)
L15	--(0 dead)

AMHERST (PD)* TABLE I-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	14	-14	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	14	20	0	20			
H15	0	17	-17	0	18	-18	0	18	-18	0	18	-18	0	18	-18	0	18	-18	0	20	-20	0	20	-20
Ms	0	9	-9	0	14	-14	0	15	-15	0	14	-14	0	13	-13	0	10	-10	3	10	-7	10	10	0
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	4	0	4
M15	0	6	-6	0	10	-10	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	17	-17	0	17	-17	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE II-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	2	0	2	3	0	3	6	0	6	12	0	12	16	0	16	20	0	20			
H9	0	0	0	0	0	0	0	0	0	5	0	5	14	0	14	20	0	20						
H15	0	10	-10	0	10	-10	0	10	-10	0	10	-10	0	10	-10	2	10	-8	12	10	2	15	10	5
Ms	0	0	0	0	0	0	0	0	0	2	0	2	3	0	3	5	0	5	11	0	11	14	0	14
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	7	0	7
M15	0	3	-3	0	2	-2	0	3	-3	0	5	-5	0	4	-4	0	6	-6	0	20	-20	0	20	-20
Ls	0	10	-10	0	15	-15	0	19	-19	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	0	0	0	0	0	2	0	2	3	0	3	9	0	9	15	0	15	20	0	20
L15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4	0	4	5	0	5

AMHERST (PD)* TABLE III-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	20	0	20			
H9	0	6	-6	0	3	-3	0	3	-3	0	0	0	0	0	0	9	0	9	20	0	20			
H15	0	7	-7	0	8	-8	0	7	-7	0	8	-8	0	11	-11	1	11	-10	20	11	9			
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	9	20	0	20			
M9	0	7	-7	0	9	-9	0	7	-7	0	7	-7	0	7	-7	5	7	-2	20	7	13			
M15	0	17	-17	0	17	-17	0	12	-12	0	10	-10	0	10	-10	0	10	-10	20	10	10			
Ls	0	20	-20	0	20	-20	0	18	-18	0	17	-17	0	10	-10	0	10	-10	7	10	-3	10	10	0
L9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	11	20	0	20			
L15	0	8	-8	0	3	-3	0	3	-3	0	3	-3	0	0	0	4	0	4	20	0	20			

AMHERST (PD)* TABLE IV-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	5	0	5	20	0	20															
H9	0	0	0	0	0	0	13	0	13	17	0	17	20	0	20									
H15	0	0	0	0	0	0	0	0	0	15	0	15	20	0	20									
Ms	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	18	20	-2
M9	0	7	-7	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	20	0			
M15	0	10	-10	0	17	-17	0	17	-17	0	20	-20	0	20	-20	0	20	-20	10	20	-10	10	20	-10
Ls	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	10	20	-10	10	20	-10
L9	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	10	20	-10	10	20	-10
L15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	10	20	-10	10	20	-10

AMHERST (PD)* TABLE V-1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	16	-16	0	16	-16	0	18	-18	0	20	-20	0	20	-20	9	19	-19	20	20	0			
H9	0	15	-15	0	14	-14	0	14	-14	0	14	-14	0	20	-20	11	14	-3	20	20	0			
H15	0	16	-16	0	20	-20	0	19	-19	0	20	-20	0	20	-20	0	20	-20	20	20	0			
Ms	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	19	-19	0	17	-17	0	19	-19	0	20	-20	0	20	-20	8	18	-10	20	17	3			
M15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	16	-16	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	19	-19	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	20	0			
L15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	14	20	-6	20	20	0

AMHERST (PD)* TABLE 1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with various chemicals.
(Based on AMHERST (PD)* TABLES I-1, II-1, III-1, IV-1 and V-1.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)*....Poorly drained

```
Soil              Elapsed time in hours (to scale)
No.   1 2 4   6  12         24                  48                   72
                         Orthodichlorobenzene
Hs    ----------------------------------------------------------( 0 dead)
H9    ----------------------x
H15   ----------------------------------------------------------( 0 dead)
Ms    ----------------------------------------------------------(10 dead)
M9    ----------------------------------------------------------( 4 dead)
M15   ----------------------------------------------------------( 0 dead)
Ls    ----------------------------------------------------------( 0 dead)
L9    ----------------------------------------------------------( 0 dead)
L15   ----------------------------------------------------------( 0 dead)
                         Paradichlorobenzene
Hs    ----------------------x
H9    -----------x
H15   ----------------------------------------------------------(15 dead)
Ms    ----------------------------------------------------------(14 dead)
M9    ----------------------------------------------------------( 7 dead)
M15   ----------------------------------------------------------( 0 dead)
Ls    ----------------------------------------------------------( 0 dead)
L9    ------------------------------------------x
L15   ----------------------------------------------------------( 5 dead)
                         Beta naphthol
Hs    ------------------------------------------x
H9    ------------------------------------------x
H15   ------------------------------------------x
Ms    ------------------------------------------x
M9    ------------------------------------------x
M15   ------------------------------------------x
Ls    ----------------------------------------------------------(10 dead)
L9    ------------------------------------------x
L15   ------------------------------------------x
                         Pentachlorophenol
Hs    ----x
H9    -------x
H15   -------x
Ms    ---------------------------------------------------------------x
M9    ------------------------------------------x
M15   ----------------------------------------------------------(10 dead)
Ls    ----------------------------------------------------------(10 dead)
L9    ----------------------------------------------------------(10 dead)
L15   ----------------------------------------------------------(10 dead)
                         White arsenic
Hs    ------------------------------------------x
H9    ------------------------------------------x
H15   ------------------------------------------x
Ms    ----------------------------------------------------------( 0 dead)
M9    ------------------------------------------x
M15   ----------------------------------------------------------( 0 dead)
Ls    ----------------------------------------------------------( 0 dead)
L9    ------------------------------------------x
L15   ------------------------------------------x
```

MEMPHIS TABLE I-2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	4	-4	0	9	-9	0	10	-10	0	10	-10	0	10	-10	0	10	-10	6	10	-4	12	10	2
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	20	0	20			
H15	0	15	-15	0	14	-14	0	16	-16	0	18	-18	0	18	-18	0	17	-17	0	16	-16	7	17	-10
Ms	0	11	-11	0	16	-16	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	3	-3	0	6	-6	0	13	-13	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	6	-6	0	12	-12	0	13	-13	0	11	-11	0	14	-14	0	20	-20	0	20	-20	0	20	-20
Ls	0	13	-13	0	14	-14	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	13	-13	0	16	-16	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	9	-9	0	10	-10	0	12	-12	0	10	-10	0	12	-12	0	18	-18	0	20	-20	0	20	-20

MEMPHIS TABLE II-2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	3	0	3	6	0	6	11	0	11	20	0	20			
H9	0	0	0	0	0	0	0	0	0	4	0	4	6	0	6	13	0	13	20	0	20			
H15	0	0	0	0	0	0	0	0	0	2	0	2	3	0	3	8	0	8	14	0	14	20	0	20
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6
M9	0	8	-8	0	8	-8	0	12	-12	0	12	-12	0	12	-12	0	12	-12	7	12	-5	7	12	-5
M15	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	10	-10	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	6	-6	0	13	-13	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	3	-3	0	10	-10	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE III-2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	16	20	0	20			
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	14	20	0	20			
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	15	20	0	20			
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	18	20	0	20			
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	17	20	0	20			
M15	0	8	-8	0	12	-12	0	10	-10	0	10	-10	0	10	-10	3	10	-7	7	10	-3	10	10	0
Ls	0	10	-10	0	8	-8	0	10	-10	0	14	-14	0	14	-14	0	13	-13	10	10	0	10	10	0
L9	0	7	-7	0	14	-14	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE IV-2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	6	0	6	20	0	20															
H9	0	0	0	8	0	8	20	0	20															
H15	0	0	0	6	0	6	16	0	16	20	0	20												
Ms	0	0	0	0	0	0	14	0	14	20	0	20												
M9	0	0	0	0	0	0	10	0	10	20	0	20												
M15	0	0	0	0	0	0	7	0	7	10	0	10	10	0	10	16	0	16	16	0	16	20	0	20
Ls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	20	0	20			
L9	0	0	0	0	0	0	0	0	0	0	2	-2	2	0	2	18	0	18	20	0	20			
L15	0	2	-2	0	9	-9	0	10	-10	0	10	-10	2	10	-8	8	10	-2	20	10	10			

MEMPHIS TABLE V-2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	10	-10	0	8	-8	0	8	-8	0	8	-8	0	8	-8	0	8	-8	14	6	10	20	6	14
H9	0	0	0	0	2	-2	0	4	-4	0	7	-7	5	8	-3	15	5	10	20	5	15			
H15	0	1	-1	0	0	0	0	2	-2	0	6	-6	4	0	4	12	0	12	20	0	20			
Ms	0	10	-10	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	17	-17	14	20	-6	20	20	0
M9	0	13	-13	0	18	-18	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	6	20	-14
M15	0	7	-7	0	10	-10	0	11	-11	0	10	-10	0	10	-10	0	10	-10	2	10	-8	6	10	-4
Ls	0	8	-8	0	13	-13	0	16	-16	0	12	-12	0	14	-14	0	16	-16	2	16	-14	10	16	-6
L9	0	8	-8	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	16	-16	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE 2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with various chemicals.
(Based on MEMPHIS TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	1	2	4	8	12	24	48	72
Orthodichlorobenzene								
Hs								(12 dead)
H9							x	
H15								(7 dead)
Ms								(0 dead)
M9								(0 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Paradichlorobenzene								
Hs							x	
H9						x		
H15							x	
Ms								(6 dead)
M9								(7 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Beta naphthol								
Hs						x		
H9						x		
H15						x		
Ms						x		
M9						x		
M15								(10 dead)
Ls								(10 dead)
L9								(0 dead)
L15								(0 dead)
Pentachlorophenol								
Hs			x					
H9			x					
H15			x					
Ms			x					
M9				x				
M15						x		
Ls							x	
L9						x		
L15							x	
White arsenic								
Hs							x	
H9						x		
H15						x		
Ms							x	
M9								(6 dead)
M15								(6 dead)
Ls								(10 dead)
L9								(0 dead)
L15								(0 dead)

RICHMOND TABLE I-2

Toxic action to termites of soil from Richmond, Va., two months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	8	-8	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	0	0	0	0	2	-2	0	2	-2	6	0	6	20	0	20			
H15	0	11	-11	0	13	-13	0	12	-12	0	15	-15	0	15	-15	0	20	-20	0	20	-20	0	20	-20
Ms	0	2	-2	0	8	-8	0	10	-10	0	10	-10	0	10	-10	0	10	-10	4	8	-4	10	10	0
M9	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	7	-7	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	9	-9	0	18	-18	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	6	-6	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE II-2

Toxic action to termites of soil from Richmond, Va., two months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H15	0	14	-14	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	2	-2	0	5	-5	0	8	-8	0	10	-10	0	9	-9	0	8	-8	10	8	2	10	8	2
M15	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	10	-10	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	3	-3	0	10	-10	0	12	-12	0	12	-12	0	15	-15	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE III-2

Toxic action to termites of soil from Richmond, Va., two months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	7	0	7	15	0	15	20	0	20						
H9	0	0	0	0	0	0	0	0	0	5	0	5	10	0	10	20	0	20						
H15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	20	0	20						
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20						
M15	0	6	-6	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	0	0	0	9	-9	0	14	-14	0	16	-16	0	16	-16	0	14	-14	8	16	-8
L9	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	16	0	16	20	0	20			
L15	0	8	-8	0	13	-13	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

Elapsed time in hours (column groups 1–72).

RICHMOND TABLE IV-2

Toxic action to termites of soil from Richmond, Va., two months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15"

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	17	0	17	20	0	20												
H9	0	0	0	0	0	0	19	0	19	20	0	20												
H15	0	0	0	0	0	0	10	0	10	15	0	15	19	0	19	20	0	20						
Ms	0	0	0	0	0	0	16	0	16	20	0	20												
M9	0	0	0	0	0	0	14	0	14	17	0	17	20	0	20									
M15	0	0	0	0	0	0	2	0	2	7	0	7	18	0	18	20	0	20						
Ls	0	0	0	0	0	0	18	0	18	20	0	20												
L9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	11	0	11	20	0	20
L15	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	9	0	9	11	0	11	20	0	20

RICHMOND TABLE V-2

Toxic action to termites of soil from Richmond, Va., two months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	7	-7	0	17	-17	0	20	-20	0	20	-20	0	20	-20	1	19	-18	1	17	-16	8	17	-9
H9	0	0	0	0	2	-2	0	6	-6	0	6	-6	7	5	2	9	6	3	19	8	11	20	8	12
H15	0	2	-2	0	4	-4	0	6	-6	9	3	6	9	4	5	17	7	10	18	7	11	20	7	13
Ms	0	2	-2	0	9	-9	0	20	-20	1	16	-15	3	16	-13	3	16	-13	3	15	-12	8	15	-7
M9	0	0	0	0	4	-4	0	18	-18	0	20	-20	0	20	-20	0	20	-20	2	18	-16	6	18	-12
M15	0	4	-4	0	9	-9	0	10	-10	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	2	-2	0	3	-3	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	5	-5	0	18	-18	0	19	-19	0	17	-17	2	18	-16	2	18	-16	11	18	-9
L15	0	0	0	0	4	-4	0	11	-11	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE 2

Toxic action to termites of soil from Richmond, Va., two months after treatment with various chemicals.
(Based on RICHMOND TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

```
Soil                     Elapsed time in hours (to scale)
No.   1 2 4   8  12           24                      48                      72
                            Orthodichlorobenzene
Hs    ------------------------------------------------------------------( 0 dead )
H9    -----------------------------------------------x
H15   ------------------------------------------------------------------( 0 dead )
Ms    ------------------------------------------------------------------(10 dead )
M9    ------------------------------------------------------------------( 0 dead )
M15   ------------------------------------------------------------------( 0 dead )
Ls    ------------------------------------------------------------------( 0 dead )
L9    ------------------------------------------------------------------( 0 dead )
L15   ------------------------------------------------------------------( 0 dead )
                            Paradichlorobenzene
Hs    ------------------------------------------------------------------( 0 dead )
H9    ------------------------------------------------------------------( 0 dead )
H15   ------------------------------------------------------------------( 0 dead )
Ms    ------------------------------------------------------------------( 0 dead )
M9    ------------------------------------------------------------------(10 dead )
M15   ------------------------------------------------------------------( 0 dead )
Ls    ------------------------------------------------------------------( 0 dead )
L9    ------------------------------------------------------------------( 0 dead )
L15   ------------------------------------------------------------------( 0 dead )
                                Beta naphthol
Hs    -----------x
H9    -----------------------x
H15   -----------------------x
Ms    -----------------------x
M9    -----------------------x
M15   ------------------------------------------------------------------( 0 dead )
Ls    ------------------------------------------------------------------( 8 dead )
L9    -----------------------x
L15   ------------------------------------------------------------------( 0 dead )
                             Pentachlorophenol
Hs    ----x
H9    ----x
H15   -------x
Ms    ----x
M9    -------x
M15   -----------x
Ls    ----x
L9    -----------------------------------------------------------------------x
L15   -----------------------------------------------------------------------x
                               White arsenic
Hs    ------------------------------------------------------------------( 8 dead )
H9    -----------------------------------------------x
H15   -----------------------x
Ms    ------------------------------------------------------------------( 8 dead )
M9    ------------------------------------------------------------------( 6 dead )
M15   ------------------------------------------------------------------( 0 dead )
Ls    ------------------------------------------------------------------( 0 dead )
L9    ------------------------------------------------------------------(11 dead )
L15   ------------------------------------------------------------------( 0 dead )
```

AMHERST (WD)* TABLE I-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	4	-4	0	7	-7	0	0	0	0	0	0	0	0	0	4	0	4	12	0	12	20	0	20
H9	3	0	3	14	0	14	16	0	16	20	0	20												
H15	2	0	2	2	0	2	6	0	6	14	0	14	18	0	18	20	0	20						
Ms	0	2	-2	0	3	-3	0	6	-6	0	10	-10	0	10	-10	2	10	-8	4	10	-6	10	10	0
M9	0	0	0	0	5	-5	0	7	-7	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	9	-9	0	12	-12	0	14	-14	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L 9	0	11	-11	0	10	-10	0	10	-10	2	10	-8	2	10	-8	2	10	-8	8	10	-2	10	10	0
L15	0	15	-15	0	15	-15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE II-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15". (WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	2	-2	2	2	0	2	2	0	2	2	0	14	2	12
H9	0	0	0	2	0	2	16	0	16	18	0	18	20	0	20									
H15	0	2	-2	0	7	-7	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	6	-6	0	8	-8	0	18	-18	0	18	-18	0	18	-18	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2	2	0	2	10	0	10
M15	0	10	-10	0	13	-13	0	18	-18	0	15	-15	0	18	-18	0	18	-18	0	20	-20	0	20	-20
Ls	0	4	-4	0	3	-3	0	7	-7	0	18	-18	0	18	-18	0	18	-18	0	20	-20	0	20	-20
L9	0	10	-10	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	0	0	0	3	-3	0	8	-8	0	10	-10	0	10	-10	2	10	-8	6	12	-6	6	12	-6

AMHERST (WD)* TABLE III-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	2	0	2	8	0	8	20	0	20						
H9	0	3	-3	0	3	-3	0	0	0	0	2	-2	8	2	6	16	2	14	20	0	20			
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	18	20	0	20			
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	20	0	20			
M9	0	0	0	0	0	0	0	0	0	2	0	2	8	0	8	10	0	10	20	0	20			
M15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	14	20	0	20			
Ls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	14	20	0	20			
L9	0	0	0	0	11	-11	0	17	-17	0	18	-18	0	13	-13	2	10	-8	4	10	-6	10	10	0
L15	0	1	-1	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE IV-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil	Elapsed time in hours: 1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	18	0	18	20	0	20												
H9	0	0	0	0	0	0	20	0	20															
H15	0	0	0	0	0	0	14	0	14	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	6	0	6	14	0	14	20	0	20						
M9	0	0	0	0	0	0	0	0	0	14	0	14	20	0	20									
M15	0	0	0	0	0	0	0	0	0	15	0	15	20	0	20									
Ls	0	0	0	0	0	0	0	0	0	10	0	10	18	0	18	20	0	20						
L9	0	6	-6	0	18	-18	0	8	-8	14	6	8	18	4	14	20	0	20						
L15	0	5	-5	0	10	-10	0	10	-10	2	10	-8	2	10	-8	2	10	-8	10	10	0	10	10	0

AMHERST (WD)* TABLE V-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	1	-1	0	5	-5	0	10	-10	0	14	-14	0	14	-14	4	12	-8	12	10	2	12	10	2
H9	0	2	-2	0	10	-10	0	10	-10	0	10	-10	2	10	-8	10	10	0	20	10	10			
H15	0	9	-9	0	12	-12	0	18	-18	0	20	-20	2	20	-18	6	12	-6	20	12	8			
Ms	0	12	-12	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	16	20	-4
M9	0	0	0	0	0	0	0	10	-10	0	18	-18	0	20	-20	0	20	-20	0	20	-20	10	16	-6
M15	0	10	-10	0	10	-10	0	13	-13	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	14	-14
Ls	0	6	-6	0	11	-11	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	12	-12	0	9	-9	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	9	-9	0	10	-10	0	10	-10	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE 2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained

```
Soil                   Elapsed time in hours (to scale)
 No.   1 2 4   8  12               24                           48                             72
                            Orthodichlorobenzene
 Hs    -----------------------------------------------------------x
 H9    ----x
 H15   --------x
 Ms    --------------------------------------------------------------------------------(10 dead)
 M9    --------------------------------------------------------------------------------( 0 dead)
 M15   --------------------------------------------------------------------------------( 0 dead)
 Ls    --------------------------------------------------------------------------------( 0 dead)
 L9    --------------------------------------------------------------------------------(10 dead)
 L15   --------------------------------------------------------------------------------( 0 dead)
                            Paradichlorobenzene
 Hs    --------------------------------------------------------------------------------(14 dead)
 H9    ----x
 H15   --------------------------------------------------------------------------------( 0 dead)
 Ms    --------------------------------------------------------------------------------( 0 dead)
 M9    --------------------------------------------------------------------------------(10 dead)
 M15   --------------------------------------------------------------------------------( 0 dead)
 Ls    --------------------------------------------------------------------------------( 0 dead)
 L9    --------------------------------------------------------------------------------( 0 dead)
 L15   --------------------------------------------------------------------------------( 6 dead)
                            Beta naphthol
 Hs    -----------------------------x
 H9    -----------------------------x
 H15   -----------------------------x
 Ms    -----------------------------------------------------------x
 M9    -----------------------------------------------------------x
 M15   -----------------------------x
 Ls    -----------------------------x
 L9    --------------------------------------------------------------------------------(10 dead)
 L15   --------------------------------------------------------------------------------( 0 dead)
                            Pentachlorophenol
 Hs    ----x
 H9    ----x
 H15   ----x
 Ms    ------------x
 M9    --------x
 M15   --------x
 Ls    ------------x
 L9    --------x
 L15   --------------------------------------------------------------------------------(10 dead)
                            White arsenic
 Hs    --------------------------------------------------------------------------------(12 dead)
 H9    -----------------------------------------------------------x
 H15   -----------------------------------------------------------x
 Ms    ---------------------------------------------------------------------------------------x
 M9    --------------------------------------------------------------------------------(10 dead)
 M15   --------------------------------------------------------------------------------( 0 dead)
 Ls    --------------------------------------------------------------------------------( 0 dead)
 L9    --------------------------------------------------------------------------------( 0 dead)
 L15   --------------------------------------------------------------------------------( 0 dead)
```

AMHERST (PD)* TABLE I-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	7	-7	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	4	-4	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	0	5	5	0	5
Ms	0	0	0	0	11	-11	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	9	-9	0	15	-15	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	0	0	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	10	-10	0	12	-12	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	11	-11	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	7	-7	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE II-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	2	0	2	6	0	6	8	0	8	9	0	9	12	0	12	16	0	16
H9	0	0	0	11	0	11	19	0	19	20	0	20												
H15	0	0	0	2	0	2	3	0	3	3	0	3	3	0	3	4	0	4	6	0	6	6	0	6
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	6	0	6	6	0	6
M9	0	0	0	0	4	-4	0	8	-8	0	14	-14	0	13	-13	0	13	-13	0	13	-13	0	13	-13
M15	0	0	0	0	0	0	0	0	0	0	2	-2	0	0	0	0	0	0	0	0	0	0	20	-20
Ls	0	8	-8	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	2	-2	0	12	-12	0	17	-17	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	2	-2	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE III-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	20	0	20						
H9	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20						
H15	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	20	0	20						
M9	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20						
M15	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20						
Ls	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20						
L9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20						
L15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20						

AMHERST (PD)* TABLE IV-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	4	0	4	12	0	12	20	0	20															
H9	1	0	1	13	0	13	20	0	20															
H15	1	0	1	12	0	12	20	0	20															
Ms	0	0	0	6	0	6	20	0	20															
M9	2	0	2	8	0	8	18	0	18	20	0	20												
M15	3	0	3	8	0	8	19	0	19	20	0	20												
Ls	0	0	0	7	0	7	16	0	16	20	0	20												
L9	0	0	0	9	0	9	18	0	18	19	0	19	20	0	20									
L15	0	0	0	3	0	3	7	0	7	14	0	14	20	0	20									

AMHERST (PD)* TABLE V-2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	15	0	15	20	0	20			
H9	0	0	0	0	4	-4	0	5	-5	0	5	-5	6	5	1	15	5	10	20	6	14			
H15	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	11	0	11	20	0	20			
Ms	0	0	0	0	15	-15	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	8	-8	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	0	0	0	5	-5	0	11	-11	0	11	-11	0	10	-10	0	10	-10	17	7	10	17	7	10
Ls	0	9	-9	0	12	-12	0	15	-15	0	15	-15	0	15	-15	0	15	-15	0	15	-15	0	15	-15
L9	0	12	-12	0	18	-18	0	18	-18	0	18	-18	0	18	-18	0	18	-18	0	18	-18	0	18	-18
L15	0	6	-6	0	17	-17	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE 2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with various chemicals.
(Based on AMHERST (PD)* TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)*....Poorly drained

```
Soil   Elapsed time in hours (to scale)
No.     12 4   8   12          24                      48                      72
                          Orthodichlorobenzene
Hs     ----------------------------------------------------------------( 0 dead)
H9     ----------------------------------------------------------------( 0 dead)
H15    ----------------------------------------------------------------( 5 dead)
Ms     ----------------------------------------------------------------( 0 dead)
M9     ----------------------------------------------------------------( 0 dead)
M15    ----------------------------------------------------------------( 0 dead)
Ls     ----------------------------------------------------------------( 0 dead)
L9     ----------------------------------------------------------------( 0 dead)
L15    ----------------------------------------------------------------( 0 dead)
                          Paradichlorobenzene
Hs     -----------------------------------------------------------------------x
H9     -----x
H15    ----------------------------------------------------------------( 6 dead)
Ms     ----------------------------------------------------------------( 6 dead)
M9     ----------------------------------------------------------------( 0 dead)
M15    ----------------------------------------------------------------( 0 dead)
Ls     ----------------------------------------------------------------( 0 dead)
L9     ----------------------------------------------------------------( 0 dead)
L15    ----------------------------------------------------------------( 0 dead)
                          Beta naphthol
Hs     -----------------------x
H9     -----------------------x
H15    -----------------------x
Ms     -----------------------x
M9     -----------------------x
M15    -----------------------x
Ls     -----------------------x
L9     -----------------------x
L15    -----------------------x
                          Pentachlorophenol
Hs     --x
H9     --x
H15    --x
Ms     ----x
M9     ----x
M15    ----x
Ls     ----x
L9     ----x
L15    --------x
                          White arsenic
Hs     -----------------------x
H9     -----------------------x
H15    -----------------------------------------------x
Ms     ----------------------------------------------------------------( 0 dead)
M9     ----------------------------------------------------------------( 0 dead)
M15    -----------------------------------------------x
Ls     ----------------------------------------------------------------( 0 dead)
L9     ----------------------------------------------------------------( 0 dead)
L15    ----------------------------------------------------------------( 0 dead)
```

MEMPHIS TABLE I-3

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	10	-10	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H15	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	2	-2	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	2	-2	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE II-3

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	18	0	18	20	0	20															
H9	0	0	0	20	0	20																		
H15	0	0	0	20	0	20																		
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	10	-6	7	10	-3	10	10	0
M9	0	10	-10	0	10	-10	0	10	-10	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20
M15	0	10	-10	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	6	-6	0	12	-12	0	10	-10	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20
L9	0	12	-12	0	10	-10	0	16	-16	0	16	-16	0	16	-16	0	16	-16	0	20	-20	0	20	-20
L15	0	10	-10	0	12	-12	0	16	-16	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE III-3

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface, 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	20	0	20												
H9	0	0	0	0	0	0	0	0	0	20	0	20												
H15	0	0	0	0	0	0	4	0	4	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	20	0	20												
M9	0	0	0	0	0	0	0	0	0	20	0	20												
M15	0	0	0	0	0	0	0	0	0	10	0	10	18	0	18	20	0	20						
Ls	0	0	0	0	0	0	0	0	0	16	0	16	20	0	20									
L9	0	0	0	0	0	0	0	0	0	6	0	6	18	0	18	20	0	20						
L15	0	12	-12	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE IV-3

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	7	0	7	14	0	14	20	0	20															
H9	0	0	0	12	0	12	20	0	20															
H15	0	0	0	2	0	2	10	0	10	20	0	20												
Ms	0	0	0	10	0	10	20	0	20															
M9	0	0	0	18	0	18	20	0	20															
M15	0	0	0	16	0	16	20	0	20															
Ls	0	0	0	14	0	14	20	0	20															
L9	0	0	0	16	0	16	20	0	20															
L15	0	0	0	20	0	20																		

MEMPHIS TABLE V-3

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	2	-2	0	2	-2	8	2	6	10	2	8	16	0	16	20	0	20			
H9	0	12	-12	0	14	-14	0	14	-14	2	16	-14	2	18	-16	2	20	-18	2	20	-18	2	20	-18
H15	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	0	0	0	0	0	0	0	0	2	0	2	6	0	6	10	0	10	18	0	18	20	0	20
M9	0	0	0	0	8	-8	0	6	-6	0	12	-12	0	12	-12	0	12	-12	8	12	-4	10	12	-2
M15	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	6	-6	0	10	-10	10	10	0	10	8	2	10	10	0	10	10	0	10	10	0	10	10	0
L9	0	10	-10	0	10	-10	6	10	-4	6	10	-4	10	8	2	14	7	7	16	7	9	16	7	9
L15	0	0	0	0	0	0	0	0	0	16	0	16	20	0	20									

MEMPHIS TABLE 3

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with various chemicals.
(Based on MEMPHIS TABLES I-3, II-3, III-3, IV-3 and V-3.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale) 1 2 4 8 12 24 48 72
	Orthodichlorobenzene
Hs	--(0 dead)
H9	--(0 dead)
H15	--(0 dead)
Ms	--(0 dead)
M9	--(0 dead)
M15	--(0 dead)
Ls	--(0 dead)
L9	--(0 dead)
L15	--(0 dead)
	Paradichlorobenzene
Hs	--x
H9	--x
H15	--x
Ms	--(10 dead)
M9	--(0 dead)
M15	--(0 dead)
Ls	--(0 dead)
L9	--(0 dead)
L15	--(0 dead)
	Beta naphthol
Hs	--------x
H9	--------x
H15	--------x
Ms	--------x
M9	--------x
M15	------------x
Ls	--------x
L9	------------x
L15	--(0 dead)
	Pentachlorophenol
Hs	--x
H9	--x
H15	--------x
Ms	--------x
M9	--x
M15	--x
Ls	--x
L9	--x
L15	--x
	White arsenic
Hs	------------------------x
H9	--(2 dead)
H15	--(0 dead)
Ms	---x
M9	--(10 dead)
M15	--(0 dead)
Ls	--(10 dead)
L9	---x
L15	--------x

RICHMOND TABLE I-3

Toxic action to termites of soil from Richmond, Va., three months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	2	-2	0	16	-16	0	14	-14	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	-9	0	20	-20
H15	0	4	-4	0	10	-10	0	8	-8	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	11	-11	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	-10	0	20	-20
M15	0	14	-14	0	13	-13	0	18	-18	0	18	-18	0	18	-18	0	20	-20	0	20	-20	0	20	-20
Ls	0	2	-2	0	5	-5	0	9	-9	0	9	-9	0	9	-9	0	18	-18	0	20	-20	0	20	-20
L9	0	5	-5	0	14	-14	0	14	-14	0	10	-10	0	12	-12	0	16	-16	0	20	-20	0	20	-20
L15	0	4	-4	0	8	-8	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE II-3

Toxic action to termites of soil from Richmond, Va., three months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	9	-9	0	7	-7	0	7	-7	0	10	-10	0	10	-10	0	10	-10	0	20	-20
H9	14	0	14	16	0	16	20	0	20															
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	-17	0	15	-15	0	20	-20
Ms	0	6	-6	0	10	-10	0	16	-16	0	16	-16	0	15	-15	0	15	-15	7	15	-8	8	15	-7
M9	0	6	-6	0	6	-6	0	10	-10	0	10	-10	0	10	-10	0	15	-15	0	18	-18	0	20	-20
M15	0	0	0	0	0	0	0	0	0	0	7	-7	0	10	-10	0	11	-11	12	7	5	12	7	5
Ls	0	0	0	0	4	-4	0	8	-8	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	7	-7	0	7	-7	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	0	0	0	8	-8	0	13	-13	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE III-3

Toxic action to termites of soil from Richmond, Va., three months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	11	0	11	20	0	20												
H9	0	0	0	0	0	0	12	0	12	20	0	20												
H15	0	0	0	0	0	0	14	0	14	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	20	0	20												
M9	0	0	0	0	0	0	0	0	0	20	0	20												
M15	0	6	-6	0	8	-8	0	8	-8	0	10	-10	0	10	-10	0	10	-10	4	10	-6	7	10	-3
Ls	0	0	0	0	0	0	0	0	0	2	0	2	8	0	8	20	0	20						
L9	0	0	0	0	0	0	0	0	0	16	0	16	20	0	20									
L15	0	3	-3	0	7	-7	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE IV-3

Toxic action to termites of soil from Richmond, Va., three months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	4	0	4	13	0	13	18	0	18	20	0	20												
H9	10	0	10	12	0	12	20	0	20															
H15	0	0	0	2	0	2	12	0	12	12	0	12	14	0	14	16	0	16	20	0	20			
Ms	8	0	8	11	0	11	14	0	14	15	0	15	17	0	17	18	0	18	20	0	20			
M9	0	0	0	0	0	0	0	0	0	5	0	5	12	0	12	15	0	15	20	0	20			
M15	0	0	0	4	0	4	5	0	5	5	0	5	5	0	5	6	0	6	20	0	20			
Ls	0	6	-6	0	4	-4	2	9	-7	7	8	-1	10	0	10	14	0	14	20	0	20			
L9	0	10	-10	0	14	-14	0	18	-18	0	18	-18	0	18	-18	0	14	-14	7	10	-3	9	10	-1
L15	0	0	0	0	4	-4	0	9	-9	0	16	-16	0	16	-16	0	16	-16	10	17	-7	10	17	-7

RICHMOND TABLE V-3

Toxic action to termites of soil from Richmond, Va., three months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	20	-20	0	0	0	0	0	0	8	0	8	12	6	6	20	6	14			
H9	0	0	0	0	20	-20	0	2	-2	0	8	-8	0	4	-4	20	0	20						
H15	0	4	-4	0	9	-9	0	12	-12	0	12	-12	0	12	-12	0	12	-12	20	7	13			
Ms	0	0	0	0	7	-7	0	11	-11	0	12	-12	7	8	-1	7	8	-1	17	12	5	20	17	3
M9	0	0	0	0	6	-6	0	16	-16	0	15	-15	0	15	-15	2	14	-12	19	14	5	20	14	6
M15	0	0	0	0	4	-4	0	14	-14	0	15	-15	0	12	-12	8	8	0	20	8	12			
Ls	0	0	0	0	9	-9	0	13	-13	0	12	-12	0	14	-14	0	14	-14	0	20	-20	0	20	-20
L9	0	6	-6	0	2	-2	0	8	-8	0	15	-15	4	6	-2	10	20	-10	20	20	0			
L15	0	9	-9	0	11	-11	0	15	-15	0	12	-12	0	16	-16	0	16	-16	14	13	1	20	13	7

RICHMOND TABLE 3

Toxic action to termites of soil from Richmond, Va., three months after treatment with various chemicals.
(Based on RICHMOND TABLES I-3, II-3, III-3, IV-3 and V-3.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale): 1	2	4	8	12	24	48	72
Orthodichlorobenzene								
Hs								(0 dead)
H9								(0 dead)
H15								(0 dead)
Ms								(0 dead)
M9								(0 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Paradichlorobenzene								
Hs								(0 dead)
H9		x						
H15								(0 dead)
Ms								(8 dead)
M9								(0 dead)
M15								(12 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Beta naphthol								
Hs					x			
H9			x					
H15			x					
Ms					x			
M9					x			
M15								(7 dead)
Ls						x		
L9					x			
L15								(0 dead)
Pentachlorophenol.								
Hs			x					
H9		x						
H15						x		
Ms					x			
M9						x		
M15							x	
Ls						x		
L9								(9 dead)
L15								(10 dead)
White arsenic								
Hs						x		
H9						x		
H15							x	
Ms							x	
M9							x	
M15							x	
Ls								(0 dead)
L9							x	
L15							x	

AMHERST (WD)* TABLE I-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	10	-10	0	16	-16	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	7	-7	0	11	-11	0	12	-12	0	14	-14	0	16	-16	0	17	-17	0	20	-20	0	20	-20
H15	0	13	-13	0	18	-18	0	17	-17	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	4	-4	0	7	-7	0	14	-14	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M15	0	6	-6	0	15	-15	0	18	-18	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	10	-10	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	6	-6	0	14	-14	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE II-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	4	-4	0	8	-8	0	10	-10	0	10	-10	6	10	-4	7	10	-3
H9	0	0	0	17	0	17	18	0	18	20	0	20												
H15	0	0	0	9	0	9	9	0	9	15	0	15	18	0	18	20	0	20						
Ms	0	0	0	0	11	-11	0	10	-10	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	4	-3	2	16	-14	2	16	-14
M15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	14	-8	8	14	-6
Ls	0	0	0	0	4	-4	0	6	-6	0	6	-6	0	12	-12	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	16	-16	0	16	-16	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	0	0	0	5	-5	0	11	-11	0	11	-11	0	14	-14	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE III-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	20	0	20									
H9	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	20	0	20						
H15	0	0	0	0	0	0	0	0	0	0	0	0	16	0	16	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	20	0	20						
M9	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	20	0	20						
M15	0	0	0	0	0	0	0	4	-4	0	4	-4	0	4	-4	2	4	-2	20	4	16			
Ls	0	15	-15	0	14	-14	0	14	-14	0	16	-16	0	12	-12	0	10	-10	20	11	9			
L9	0	11	-11	0	13	-13	0	17	-17	0	17	-17	0	17	-17	0	17	-17	0	17	-17	0	17	-17
L15	0	17	-17	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE IV-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	10	0	10	18	0	18	20	0	20												
H9	0	0	0	13	0	13	18	0	18	20	0	20												
H15	0	0	0	9	0	9	20	0	20															
Ms	0	0	0	4	0	4	16	0	16	20	0	20												
M9	0	0	0	2	0	2	5	0	5	17	0	17	20	0	20									
M15	0	0	0	2	0	2	19	0	19	20	0	20												
Ls	0	0	0	0	0	0	3	0	3	10	0	10	16	0	16	20	0	20						
L9	0	3	-3	3	4	-1	12	4	8	20	4	16												
L15	0	2	-2	3	4	-1	6	2	-4	13	2	11	20	2	18									

AMHERST (WD)* TABLE V-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	13	-13	0	14	-14	0	16	-16	0	15	-15	0	18	-18	0	19	-19	2	17	-15	4	17	-13
H9	0	6	-6	0	12	-12	0	15	-15	0	16	-16	0	16	-16	1	12	-11	13	14	-1	20	15	5
H15	0	12	-12	0	16	-16	0	16	-16	0	15	-15	0	18	-18	0	19	-19	20	13	7			
Ms	0	16	-16	0	16	-16	0	18	-18	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	11	-11	0	14	-14	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	13	-13	0	15	-15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	14	-14	0	16	-16	0	15	-15	0	15	-15	0	15	-15	0	20	-20	0	20	-20	0	20	-20
L9	0	9	-9	0	16	-16	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	9	-9	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE 3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-3, II-3, III-3, IV-3 and V-3.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained

```
Soil                     Elapsed time in hours (to scale)
No.     1  2 4     8   12            24                            48                             72
                               Orthodichlorobenzene
Hs      --------------------------------------------------------------------------------( 0 dead)
H9      --------------------------------------------------------------------------------( 0 dead)
H15     --------------------------------------------------------------------------------( 0 dead)
Ms      --------------------------------------------------------------------------------( 0 dead)
M9      --------------------------------------------------------------------------------( 0 dead)
M15     --------------------------------------------------------------------------------( 0 dead)
Ls      --------------------------------------------------------------------------------( 0 dead)
L9      --------------------------------------------------------------------------------( 0 dead)
L15     --------------------------------------------------------------------------------( 0 dead)
                               Paradichlorobenzene
Hs      --------------------------------------------------------------------------------( 7 dead)
H9      --x
H15     ---------x
Ms      --------------------------------------------------------------------------------( 0 dead)
M9      --------------------------------------------------------------------------------( 2 dead)
M15     --------------------------------------------------------------------------------( 8 dead)
Ls      --------------------------------------------------------------------------------( 0 dead)
L9      --------------------------------------------------------------------------------( 0 dead)
L15     --------------------------------------------------------------------------------( 0 dead)
                                  Beta naphthol
Hs      --------------x
H9      -----------------------------x
H15     --------------x
Ms      -----------------------------x
M9      -----------------------------x
M15     ----------------------------------------------------------x
Ls      ----------------------------------------------------------x
L9      --------------------------------------------------------------------------------( 0 dead)
L15     --------------------------------------------------------------------------------( 0 dead)
                               Pentachlorophenol
Hs      ----x
H9      ----x
H15     ----x
Ms      ----x
M9      ---------x
M15     ----x
Ls      --------------x
L9      ----x
L15     ---------x
                                 White arsenic
Hs      --------------------------------------------------------------------------------( 4 dead)
H9      ----------------------------------------------------------x
H15     ----------------------------------------------------------x
Ms      --------------------------------------------------------------------------------( 0 dead)
M9      --------------------------------------------------------------------------------( 0 dead)
M15     --------------------------------------------------------------------------------( 0 dead)
Ls      --------------------------------------------------------------------------------( 0 dead)
L9      --------------------------------------------------------------------------------( 0 dead)
L15     --------------------------------------------------------------------------------( 0 dead)
```

AMHERST (PD)* TABLE I-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	2	-2	0	7	-7	0	11	-11	0	18	-18	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	0	4	-4	0	4	-4	0	8	-8	0	20	-20	0	20	-20	0	20	-20
H15	0	0	0	0	0	0	0	4	-4	0	6	-6	0	8	-8	0	10	-10	0	20	-20	0	20	-20
Ms	0	0	0	0	16	-16	0	15	-15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	6	-6	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	0	0	0	2	-2	0	2	-2	0	10	-10	0	12	-12	0	14	-14	6	10	-4	6	10	-4
Ls	0	10	-10	0	14	-14	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	7	-7	0	8	-8	0	6	-6	0	14	-14	0	15	-15	0	20	-20	0	20	-20
L15	0	13	-13	0	11	-11	0	12	-12	0	14	-14	0	15	-15	0	17	-17	0	20	-20	0	20	-20

AMHERST (PD)* TABLE II-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	9	0	9	20	0	20																		
H9	0	0	0	1	0	1	5	0	5	9	0	9	11	0	11	13	0	13	15	0	15	16	0	16
H15	0	0	0	0	0	0	2	0	2	12	0	12	12	0	12	12	0	12	16	0	16	18	0	18
Ms	0	0	0	0	0	0	0	0	0	0	0	0	0	5	-5	0	10	-10	0	10	-10	0	10	-10
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	5	-5	0	10	-10	0	10	-10	0	10	-10
M15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	-10	0	20	-20	0	20	-20
Ls	0	8	-8	0	13	-13	0	6	-6	0	13	-13	0	16	-16	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	18	-18	0	20	-20	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	10	-10	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE III-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	2	0	2	14	0	14	20	0	20						
H9	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	20	0	20						
H15	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	20	0	20						
M9	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	20	0	20						
M15	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	20	0	20						
Ls	0	0	0	0	0	0	0	2	-2	0	10	-10	0	15	-15	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	20	0	20						
L15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	20	0	20			

AMHERST (PD)* TABLE IV-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H,M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	12	0	12	20	0	20															
H9	0	0	0	8	0	8	20	0	20															
H15	0	0	0	15	0	15	20	0	20															
Ms	0	0	0	6	0	6	12	0	12	20	0	20												
M9	0	0	0	0	0	0	2	0	2	20	0	20												
M15	0	0	0	0	0	0	0	0	0	20	0	20												
Ls	0	0	0	0	0	0	0	0	0	20	0	20												
L9	0	0	0	0	0	0	12	0	12	20	0	20												
L15	0	0	0	0	0	0	13	0	13	20	0	20												

AMHERST (PD)* TABLE V-3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	6	-6	0	6	-6	0	20	-20	0	20	-20	0	20	-20	8	20	-12	20	20	0			
H9	0	6	-6	0	7	-7	0	12	-12	0	18	-18	3	13	-10	6	13	-7	20	12	8			
H15	0	0	0	0	0	0	0	0	0	6	0	6	20	0	20									
Ms	0	0	0	0	0	0	0	8	-8	0	20	-20	0	20	-20	0	20	-20	0	20	-20	8	18	-10
M9	0	2	-2	0	10	-10	0	10	-10	0	15	-15	9	15	-6	10	15	-5	20	16	4			
M15	0	0	0	0	0	0	0	0	0	8	0	8	19	5	14	20	5	15						
Ls	0	10	-10	0	12	-12	0	18	-18	0	20	-20	3	17	-14	3	17	-14	3	17	-14	3	17	-14
L9	0	12	-12	0	14	-14	0	10	-10	6	10	-4	10	10	0	10	10	0	10	10	0	20	10	10
L15	0	10	-10	0	12	-12	0	10	-10	0	10	-10	6	10	-4	8	10	-2	10	10	0	10	10	0

AMHERST (PD)* TABLE 3

Toxic action to termites of soil from Amherst, Mass., three months after treatment with various chemicals.
(Based on AMHERST (PD)* TABLES I-3, II-3, III-3, IV-3 and V-3.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)*....Poorly drained

```
Soil   Elapsed time in hours (to scale)
No.    12 4   8   12          24                      48                      72
                          Orthodichlorobenzene
Hs     -----------------------------------------------------------------( 0 dead)
H9     -----------------------------------------------------------------( 0 dead)
H15    -----------------------------------------------------------------( 0 dead)
Ms     -----------------------------------------------------------------( 0 dead)
M9     -----------------------------------------------------------------( 0 dead)
M15    -----------------------------------------------------------------( 6 dead)
Ls     -----------------------------------------------------------------( 0 dead)
L9     -----------------------------------------------------------------( 0 dead)
L15    -----------------------------------------------------------------( 0 dead)
                          Paradichlorobenzene
Hs     --x
H9     -----------------------------------------------------------------------x
H15    -----------------------------------------------x
Ms     -----------------------------------------------------------------( 0 dead)
M9     -----------------------------------------------------------------( 0 dead)
M15    -----------------------------------------------------------------( 0 dead)
Ls     -----------------------------------------------------------------( 0 dead)
L9     -----------------------------------------------------------------( 0 dead)
L15    -----------------------------------------------------------------( 0 dead)
                          Beta naphthol
Hs     -----------x
H9     -----------------------x
H15    -----------------------x
Ms     -----------------------x
M9     -----------------------x
M15    -----------------------x
Ls     -----------------------------------------------------------------( 0 dead)
L9     -----------------------x
L15    -----------------------------------------------x
                          Pentachlorophenol
Hs     --x
H9     ----x
H15    --x
Ms     ----x
M9     --------x
M15    --------x
Ls     --------x
L9     ----x
L15    ----x
                          White arsenic
Hs     -----------------------------------------------x
H9     -----------------------------------------------x
H15    -----------x
Ms     -----------------------------------------------------------------( 8 dead)
M9     -----------------------------------------------x
M15    -----------x
Ls     -----------------------------------------------------------------( 3 dead)
L9     -----------------------------------------------------------------------x
L15    -----------------------------------------------------------------(10 dead)
```

MEMPHIS TABLE I-5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	7	-7	0	16	-16	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	8	-8	0	14	-14	0	10	-10	0	12	-12	0	16	-16	4	16	-12	4	16	-16
H15	0	0	0	0	4	-4	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	0	0	0	15	-15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	15	-15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	12	-12	0	14	-14	0	12	-12	0	6	-6	0	12	-12	0	20	-20	0	20	-20	0	20	-20
Ls	0	5	-5	0	10	-10	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	10	-10	0	10	-10	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	9	-9	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE II-5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P. Arbitrary score, dead minus penetrated, shown in column D-P. High, medium and low concentrations shown by H, M and L. Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	5	-5	0	5	-5	0	0	0	0	0	0	0	8	-8	0	14	-14	0	20	-20	0	20	-20
H9	0	0	0	2	0	2	10	0	10	10	0	10	10	2	8	10	5	5	18	5	13	20	5	15
H15	0	0	0	2	0	2	4	0	4	10	0	10	10	2	8	10	4	6	14	6	8	18	6	12
Ms	0	6	-6	0	5	-5	0	8	-8	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	5	-5	0	12	-12	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	0	0	0	0	0	0	4	-4	0	6	-6	0	8	-8	0	15	-15	0	17	-17	0	20	-20
Ls	0	9	-9	0	7	-7	0	14	-14	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	10	-10	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	0	0	0	4	-4	0	0	0	0	0	0	0	8	-8	0	20	-20	0	20	-20	0	20	-20

MEMPHIS TABLE III-5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	20	0	20						
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	12	-12	20	0	20						
H15	0	0	0	0	0	0	0	0	0	2	0	2	8	0	8	20	0	20						
Ms	0	15	-15	0	17	-17	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	6	-6	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	0	0	0	5	-5	0	8	-8	0	8	-8	3	10	-7	10	10	0	10	10	0	10	10	0
Ls	0	6	-6	0	11	-11	0	14	-14	0	9	-9	0	9	-9	4	10	-6	10	10	0	10	10	0
L9	0	11	-11	0	16	-16	0	16	-16	0	16	-16	0	16	-16	4	16	-12	4	16	-12	4	16	-12
L15	0	5	-5	0	10	-10	0	12	-12	0	12	-12	12	10	2	14	10	4	14	10	4	14	10	4

MEMPHIS TABLE IV-5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	15	0	15	20	0	20															
H9	0	0	0	20	0	20																		
H15	0	0	0	15	0	15	20	0	20															
Ms	0	0	0	8	0	8	20	0	20															
M9	0	0	0	15	0	15	20	0	20															
M15	0	0	0	7	0	7	10	5	5	20	0	20												
Ls	0	0	0	0	0	0	8	0	8	20	0	20												
L9	0	0	0	7	0	7	10	0	10	20	0	20												
L15	0	0	0	8	0	8	20	0	20															

MEMPHIS TABLE V-5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Elapsed time in hours

Soil No.	1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	8	-8	0	10	-10	0	10	-10	7	10	-3	7	10	-3	7	10	-3	14	10	4	20	10	10
H9	0	2	-2	0	2	-2	12	0	12	20	0	20												
H15	0	2	-2	0	6	-6	2	14	-12	10	10	0	10	10	0	10	10	0	20	10	10			
Ms	0	2	-2	0	14	-14	0	17	-17	0	20	-20	0	20	-20	0	20	-20	20	12	8			
M9	0	0	0	0	10	-10	6	10	-4	8	10	-2	10	10	0	10	10	0	20	7	13			
M15	0	0	0	0	11	-11	0	18	-18	0	20	-20	0	20	-20	0	20	-20	18	18	0	20	18	2
Ls	0	0	0	0	2	-2	0	6	-6	0	10	-10	0	15	-15	0	20	-20	11	12	-1	16	12	4
L9	0	7	-7	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	18	2			
L15	0	9	-9	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	20	20	0			

MEMPHIS TABLE 5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with various chemicals.
(Based on MEMPHIS TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

Soil No.	Elapsed time in hours (to scale) 1	2	4	8	12	24	48	72
Orthodichlorobenzene								
Hs								(0 dead)
H9								(4 dead)
H15								(0 dead)
Ms								(0 dead)
M9								(0 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Paradichlorobenzene								
Hs								(0 dead)
H9							x	
H15							x	
Ms								(0 dead)
M9								(0 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Beta naphthol								
Hs						x		
H9						x		
H15						x		
Ms								(0 dead)
M9								(0 dead)
M15								(10 dead)
Ls								(10 dead)
L9								(4 dead)
L15								(14 dead)
Pentachlorophenol								
Hs		x						
H9		x						
H15		x						
Ms			x					
M9		x						
M15				x				
Ls				x				
L9				x				
L15			x					
White arsenic								
Hs							x	
H9			x					
H15							x	
Ms							x	
M9							x	
M15							x	
Ls								x
L9							x	
L15							x	

RICHMOND TABLE I-5

Toxic action to termites of soil from Richmond, Va., five months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Elapsed time in hours

Soil	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	2	-2	0	7	-7	0	3	-3	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	4	0	4	4	2	2	4	0	4	8	0	8	8	0	8	8	0	8
H15	0	2	-2	0	11	-11	0	10	-10	0	14	-14	0	18	-18	0	15	-15	0	20	-20	0	20	-20
Ms	0	4	-4	0	16	-16	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	14	-14	0	17	-17	0	16	-16	0	19	-19	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	11	-11	0	18	-18	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	4	-4	0	12	-12	0	19	-19	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	0	0	0	9	-9	0	15	-15	0	17	-17	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	8	-8	0	10	-10	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE II-5

Toxic action to termites of soil from Richmond, Va., five months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	7	-7	0	8	-8	0	15	-15	0	17	-17	0	20	-20	0	20	-20	2	18	-16	10	18	-8
H9	0	0	0	0	0	0	5	0	5	5	0	5	9	0	9	13	0	13	13	0	13	17	0	17
H15	0	0	0	0	0	0	0	4	-4	0	10	-10	0	16	-16	0	20	-20	0	20	-20	0	20	-20
Ms	0	0	0	0	0	0	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	7	-7	0	7	-7	0	8	-8	0	4	-4	0	11	-11	0	20	-20	0	20	-20	0	20	-20
M15	0	6	-6	0	16	-16	0	17	-17	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	0	0	0	0	0	0	12	-12	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	16	-16	0	15	-15	0	13	-13	0	6	-6	0	14	-14	0	17	-17	0	17	-17	0	20	-20
L15	0	18	-18	0	19	-19	0	14	-14	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE III-5

Toxic action to termites of soil from Richmond, Va., five months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	4	0	4	8	0	8	20	0	20						
H9	0	0	0	0	0	0	0	0	0	9	0	9	14	0	14	20	0	20						
H15	0	0	0	0	0	0	0	0	0	12	0	12	16	0	16	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	10	0	10	14	0	14	20	0	20						
M9	0	0	0	0	0	0	0	0	0	8	0	8	16	0	16	20	0	20						
M15	0	0	0	0	0	0	0	0	0	4	0	4	9	0	9	20	0	20						
Ls	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	15	0	15	20	0	20			
L9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	18	0	18	20	0	20
L15	0	0	0	0	2	-2	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20

RICHMOND TABLE IV-5

Toxic action to termites of soil from Richmond, Va., five months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	1	0	1	2	0	2	16	0	16	20	0	20												
H9	0	0	0	0	0	0	14	0	14	20	0	20												
H15	0	0	0	0	0	0	15	0	15	20	0	20												
Ms	0	0	0	0	0	0	15	0	15	16	0	16	20	0	20									
M9	3	0	3	3	0	3	7	0	7	20	0	20												
M15	0	0	0	0	0	0	11	0	11	11	0	11	16	0	16	20	0	20						
Ls	0	4	-4	0	5	-5	0	8	-8	11	6	5	17	2	15	20	0	20						
L9	0	0	0	0	0	0	3	0	3	14	0	14	20	0	20									
L15	0	5	-5	0	6	-6	0	5	-5	0	8	-8	9	8	1	20	12	8						

RICHMOND TABLE V-5

Toxic action to termites of soil from Richmond, Va., five months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	8	-8	0	10	-10	0	10	-10	0	13	-13	0	17	-17	0	19	-19	8	18	-10	20	18	2
H9	0	0	0	0	2	-2	19	0	19	19	0	19	20	0	20									
H15	0	0	0	0	0	0	0	0	0	6	0	6	9	0	9	17	0	17	20	0	20			
Ms	0	2	-2	0	6	-6	0	3	-3	0	4	-4	5	0	5	20	0	20						
M9	4	8	-4	4	8	-4	14	8	6	20	13	7												
M15	0	12	-12	0	19	-19	0	19	-19	0	20	-20	0	17	-17	0	15	-15	8	8	0	12	12	0
Ls	0	1	-1	0	16	-16	0	17	-17	0	18	-18	0	17	-17	1	16	-15	1	20	-19	4	20	-16
L9	0	11	-11	0	17	-17	0	18	-18	0	20	-20	0	19	-19	3	15	-12	17	6	11	20	6	14
L15	0	10	-10	0	20	-20	0	16	-16	0	20	-20	0	18	-18	0	19	-19	0	20	-20	0	20	-20

RICHMOND TABLE 5

Toxic action to termites of soil from Richmond, Va., five months after treatment with various chemicals.
(Based on RICHMOND TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.

```
Soil                              Elapsed time in hours (to scale)
No.     1 2  4    6    12            24                            48                            72
                                     Orthodichlorobenzene
Hs      ----------------------------------------------------------------------------------( 0 dead )
H9      ----------------------------------------------------------------------------------( 6 dead )
H15     ----------------------------------------------------------------------------------( 0 dead )
Ms      ----------------------------------------------------------------------------------( 0 dead )
M9      ----------------------------------------------------------------------------------( 0 dead )
M15     ----------------------------------------------------------------------------------( 0 dead )
Ls      ----------------------------------------------------------------------------------( 0 dead )
L9      ----------------------------------------------------------------------------------( 0 dead )
L15     ----------------------------------------------------------------------------------( 0 dead )
                                     Paradichlorobenzene
Hs      ----------------------------------------------------------------------------------(10 dead )
H9      ------------------------------------------------------------------------------------------x
H15     ----------------------------------------------------------------------------------( 0 dead )
Ms      ----------------------------------------------------------------------------------( 0 dead )
M9      ----------------------------------------------------------------------------------( 0 dead )
M15     ----------------------------------------------------------------------------------( 0 dead )
Ls      ----------------------------------------------------------------------------------( 0 dead )
L9      ----------------------------------------------------------------------------------( 0 dead )
L15     ----------------------------------------------------------------------------------( 0 dead )
                                     Beta naphthol
Hs      ------------------------------x
H9      ---------------x
H15     ---------------x
Ms      ---------------x
M9      ---------------x
M15     ------------------------------x
Ls      ------------------------------x
L9      ------------------------------------------------------------x
L15     ----------------------------------------------------------------------------------( 0 dead )
                                     Pentachlorophenol
Hs      -----x
H9      -----x
H15     -----x
Ms      ----------x
M9      ----------x
M15     ---------------x
Ls      ---------------x
L9      ----------x
L15     ------------------------------x
                                     White arsenic
Hs      ----------------------------------------------------------------------------------(------x
H9      -----x
H15     ------------------------------x
Ms      ------------------------------x
M9      -----x
M15     ----------------------------------------------------------------------------------(12 dead )
Ls      ----------------------------------------------------------------------------------( 4 dead )
L9      ------------------------------------------------------------x
L15     ----------------------------------------------------------------------------------( 0 dead )
```

AMHERST (WD)* TABLE I-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	11	-11	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	2	0	2	7	0	7	11	0	11	11	0	11	12	0	12	14	0	14	20	0	20
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	3	-3	0	7	-7	5	8	-3	20	8	12
Ms	0	6	-6	0	10	-10	0	12	-12	0	13	-13	0	16	-16	0	19	-19	0	20	-20	0	20	-20
M9	0	0	0	0	2	-2	0	4	-4	0	3	-3	0	3	-3	0	2	-2	6	0	6	20	0	20
M15	0	0	0	0	4	-4	0	9	-9	0	9	-9	2	12	-10	5	12	-7	5	14	-9	10	14	-4
Ls	0	6	-6	0	7	-7	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	6	-6	0	13	-13	0	18	-18	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	0	0	0	9	-9	0	10	-10	0	11	-11	0	18	-18	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE II-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
H9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	16	0	16	20	0	20
H15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	7	10	-3	10	10	0
Ms	0	9	-9	0	9	-9	0	9	-9	0	10	-10	0	10	-10	0	10	-10	0	10	-10	10	10	0
M9	0	0	0	0	0	0	0	0	0	0	3	-3	0	4	-4	7	10	-3	8	10	-2	10	10	0
M15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	-5	13	7	6	13	7	6
Ls	0	0	0	0	0	0	0	4	-4	0	10	-10	0	10	-10	5	10	-5	10	10	0	10	10	0
L9	0	9	-9	0	12	-12	0	14	-14	0	14	-14	0	16	-16	0	17	-17	0	20	-20	0	20	-20
L15	0	0	0	0	0	0	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE III-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	13	0	13	18	0	18	20	0	20						
H9	0	0	0	0	0	0	0	0	0	14	0	14	17	0	17	20	0	20						
H15	0	0	0	0	0	0	0	0	0	9	0	9	16	0	16	20	0	20						
Ms	0	0	0	0	0	0	0	0	0	3	0	3	8	0	8	20	0	20						
M9	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	15	0	15	20	0	20			
M15	0	0	0	0	0	0	0	0	0	4	0	4	8	0	8	15	0	15	20	0	20			
Ls	0	0	0	0	0	0	0	0	0	9	0	9	16	0	16	20	0	20						
L9	0	0	0	0	0	0	0	0	0	5	0	5	8	0	8	20	0	20						
L15	0	0	0	0	0	0	0	0	0	4	0	4	7	0	7	20	0	20						

AMHERST (WD)* TABLE IV-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	11	0	11	20	0	20												
H9	0	0	0	0	0	0	9	0	9	20	0	20												
H15	0	10	-10	0	10	-10	6	10	-4	10	10	0	10	10	0	10	10	0	10	10	0	10	10	0
Ms	0	0	0	0	0	0	0	0	0	7	0	7	9	0	9	16	0	16	20	0	20			
M9	0	0	0	0	0	0	0	0	0	3	0	3	18	0	18	20	0	20						
M15	0	0	0	0	0	0	7	0	7	18	0	18	20	0	20									
Ls	0	0	0	0	0	0	0	0	0	2	0	2	6	0	6	9	0	9	20	0	20			
L9	0	0	0	0	0	0	0	0	0	3	0	3	8	0	8	16	0	16	20	0	20			
L15	0	0	0	0	0	0	0	0	0	2	0	2	8	0	8	14	0	14	20	0	20			

AMHERST (WD)* TABLE V-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(WD)*....Well drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	0	0	0	0	2	-2	0	2	-2	2	0	2	20	0	20			
H9	0	0	0	0	0	0	0	2	-2	0	0	0	0	0	0	4	0	4	20	0	20			
H15	0	10	-10	0	10	-10	0	10	-10	0	10	-10	0	10	-10	4	10	-6	10	10	0	10	10	0
Ms	0	5	-5	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	5	20	-15	20	20	0
M9	0	0	0	0	2	-2	0	4	-4	0	6	-6	0	8	-8	3	8	-5	6	9	-3	20	13	7
M15	0	0	0	0	0	0	0	7	-7	0	5	-5	0	5	-5	3	0	3	10	0	10	20	0	20
Ls	0	4	-4	0	10	-10	0	10	-10	0	10	-10	0	10	-10	2	10	-8	4	10	-6	10	10	0
L9	0	0	0	0	3	-3	0	5	-5	0	6	-6	0	6	-6	4	6	-2	9	3	6	20	4	16
L15	0	10	-10	0	10	-10	0	10	-10	0	6	-6	0	6	-6	0	20	-20	0	20	-20	0	20	-20

AMHERST (WD)* TABLE 5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained

Soil No.	1	2	4	8	12	24	48	72
						Orthodichlorobenzene		
Hs								(0 dead)
H9							x	
H15								x
Ms								(0 dead)
M9								x
M15								(10 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
						Paradichlorobenzene		
Hs								(0 dead)
H9							x	
H15								(10 dead)
Ms								(10 dead)
M9								(10 dead)
M15								(13 dead)
Ls								(10 dead)
L9								(0 dead)
L15								(0 dead)
						Beta naphthol		
Hs					x			
H9					x			
H15					x			
Ms						x		
M9						x		
M15						x		
Ls					x			
L9						x		
L15						x		
						Pentachlorophenol		
Hs				x				
H9				x				
H15								(10 dead)
Ms						x		
M9					x			
M15				x				
Ls							x	
L9						x		
L15						x		
						White arsenic		
Hs							x	
H9							x	
H15								(10 dead)
Ms								x
M9								x
M15								x
Ls								(10 dead)
L9								x
L15								(0 dead)

AMHERST (PD)* TABLE I-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with orthodichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	10	-10	0	18	-18	0	12	-12	0	16	-16	0	18	-18	0	18	-18	0	20	-20	0	20	-20
H9	20	0	20																					
H15	4	0	4	8	0	8	8	0	8	8	0	8	8	0	8	8	0	8	13	0	13	17	0	17
Ms	0	12	-12	0	12	-12	0	12	-12	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE II-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with paradichlorobenzene.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	2	-2	0	8	-8	0	8	-8	0	8	-8	0	8	-8	6	14	-8	6	14	-8
H9	0	0	0	2	0	2	11	0	11	14	0	14	14	0	14	14	0	14	17	0	17	17	0	17
H15	0	4	-4	0	14	-14	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ms	0	2	-2	0	6	-6	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M9	0	0	0	0	16	-16	0	18	-18	0	18	-18	0	18	-18	0	18	-18	4	17	-13	10	17	-7
M15	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2
Ls	0	8	-8	0	16	-16	0	16	-16	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	9	-9	0	13	-13	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE III-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with beta naphthol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil	Elapsed time in hours																							
	1			2			4			8			12			24			48			72		
No.	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	0	0	0	2	0	2	4	0	4	16	0	16	20	0	20						
H9	0	0	0	0	0	0	0	0	0	20	0	20												
H15	0	0	0	0	0	0	0	0	0	20	0	20												
Ms	0	0	0	0	0	0	0	0	0	18	0	18	20	0	20									
M9	0	0	0	0	0	0	0	0	0	20	0	20												
M15	0	0	0	0	0	0	0	0	0	2	0	2	12	0	12	14	0	14	18	0	18	20	0	20
Ls	0	0	0	0	0	0	0	0	0	20	0	20												
L9	0	0	0	0	0	0	0	0	0	18	0	18	20	0	20									
L15	0	0	0	0	0	0	0	0	0	6	0	6	12	0	12	16	0	16	20	0	20			

AMHERST (PD)* TABLE IV-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with pentachlorophenol.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours: 1			2			4			8			12			24			48			72		
	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P	D	P	D-P
Hs	0	0	0	17	0	17	18	0	18	20	0	20												
H9	0	0	0	16	0	16	20	0	20															
H15	0	0	0	2	0	2	18	0	18	20	0	20												
Ms	0	0	0	0	0	0	6	0	6	11	0	11	18	0	18	20	0	20						
M9	0	0	0	0	0	0	3	0	3	18	0	18	20	0	20									
M15	0	0	0	0	0	0	7	0	7	20	0	20												
Ls	0	13	-13	0	15	-15	4	16	-12	4	18	-14	6	18	-12	9	18	-9	20	18	2			
L9	0	9	-9	0	17	-17	0	20	-20	0	20	-20	0	20	-20	4	20	-16	20	20	0			
L15	0	0	0	0	0	0	11	0	11	20	0	20												

AMHERST (PD)* TABLE V-5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with white arsenic.

Two tests, each using 10 termites, run on each soil sample; the total number which are dead, shown in column D; the total number which have penetrated, shown in column P.
Arbitrary score, dead minus penetrated, shown in column D-P.
High, medium and low concentrations shown by H, M and L.
Depth of samples shown by s, surface; 9, 9"; 15, 15".
(PD)*....Poorly drained

Soil No.	Elapsed time in hours 1 D	P	D-P	2 D	P	D-P	4 D	P	D-P	8 D	P	D-P	12 D	P	D-P	24 D	P	D-P	48 D	P	D-P	72 D	P	D-P
Hs	0	4	-4	0	8	-8	0	8	-8	0	8	-8	0	8	-8	2	6	-4	17	4	13	20	4	16
H9	0	2	-2	0	2	-2	4	2	2	14	2	12	18	2	16	20	2	18						
H15	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	4	20	-16	8	20	-12
Ms	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	4	17	-13	5	17	-12
M9	0	10	-10	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
M15	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
Ls	0	10	-10	0	12	-12	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L9	0	16	-16	0	18	-18	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20
L15	0	9	-9	0	14	-14	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20	0	20	-20

AMHERST (PD)* TABLE 5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with various chemicals.
(Based on AMHERST (PD)* TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)*....Poorly drained

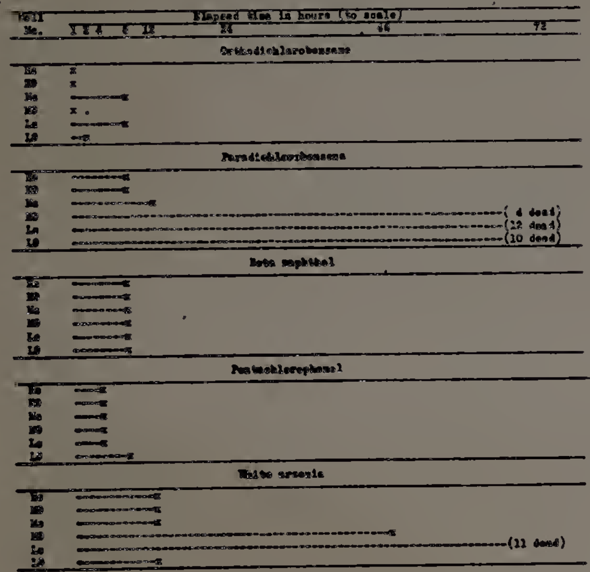
Soil No.	1	2	4	8	12	24	48	72
Orthodichlorobenzene								
Hs								(0 dead)
H9	x							
H15								x
Ms								(0 dead)
M9								(0 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Paradichlorobenzene								
Hs								(6 dead)
H9							x	
H15								(0 dead)
Ms								(0 dead)
M9								(10 dead)
M15								(2 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)
Beta naphthol								
Hs					x			
H9				x				
H15				x				
Ms				x				
M9				x				
M15						x		
Ls				x				
L9				x				
L15						x		
Pentachlorophenol								
Hs		x						
H9		x						
H15			x					
Ms					x			
M9				x				
M15				x				
Ls							x	
L9							x	
L15				x				
White arsenic								
Hs							x	
H9				x				
H15								(8 dead)
Ms								(5 dead)
M9								(0 dead)
M15								(0 dead)
Ls								(0 dead)
L9								(0 dead)
L15								(0 dead)

The following meteorological data (pages 239 to 245) has been assembled from various weather bureau reports as indicated . A summary table has also been prepared (pg. 246) giving the average mean daily temperature for each period, the average mean daily temperature since the original application of the chemicals in each area, the precipitation for each period, and the total precipitation since the original application of the chemicals. The average temperature for each successive 5-day period has also been computed for each area and is plotted on a graph on pages 239 to 245.

Photographic plates have been made of all of the summary tables in the preceding section and are included in the following pages. Plate I is composed of MEMPHIS TABLES O, I, II, III and V; Plate II is composed of RICHMOND TABLES O, I, II, III and V; Plate III is composed of AMHERST (WD) TABLES O, I, II, III and V, and Plate IV is composed of AMHERST (PD) TABLES O, I, II, III and V.

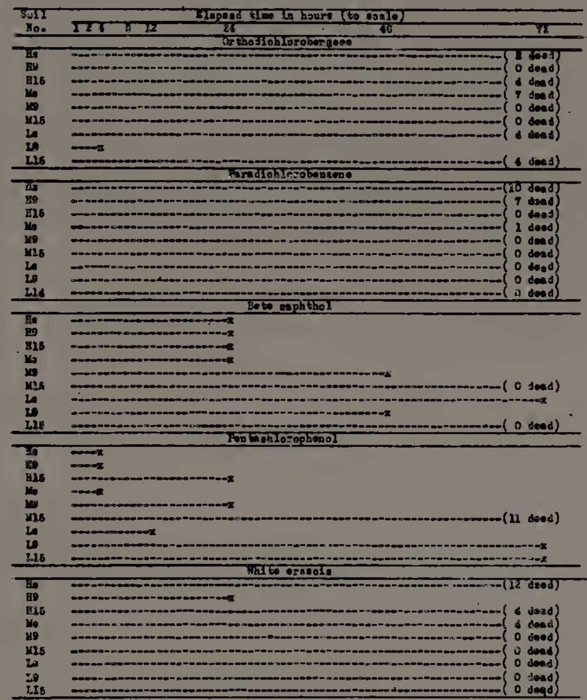
MEMPHIS TABLE 0

Toxic action to termites of soil from Memphis, Tenn., immediately after treatment with various chemicals.
(Based on MEMPHIS TABLES I-0, II-0, III-0, IV-0 and V-0.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.



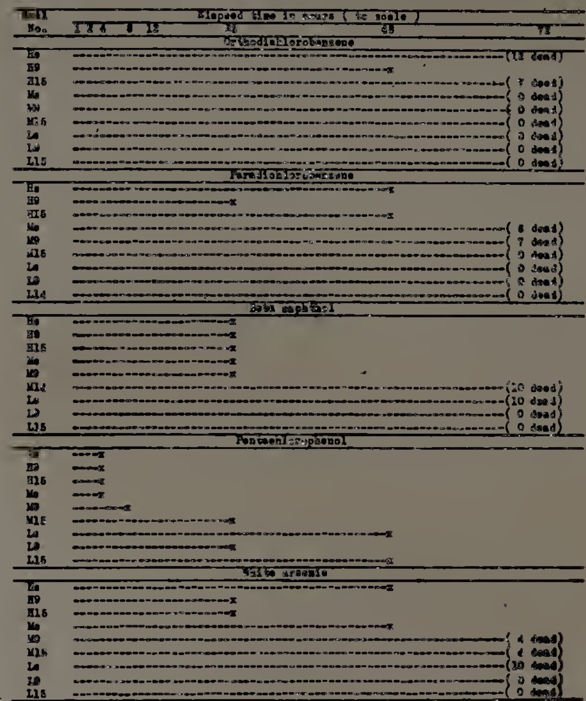
MEMPHIS TABLE 1

Toxic action to termites of soil from Memphis, Tenn., one month after treatment with various chemicals.
(Based on MEMPHIS TABLES I-1, II-1, III-1, IV-1 and V-1.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.



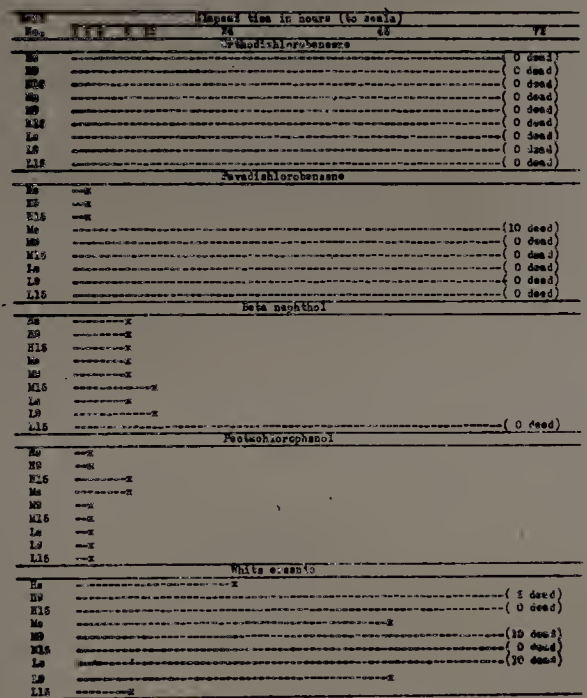
MEMPHIS TABLE 2

Toxic action to termites of soil from Memphis, Tenn., two months after treatment with various chemicals.
(Based on MEMPHIS TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.



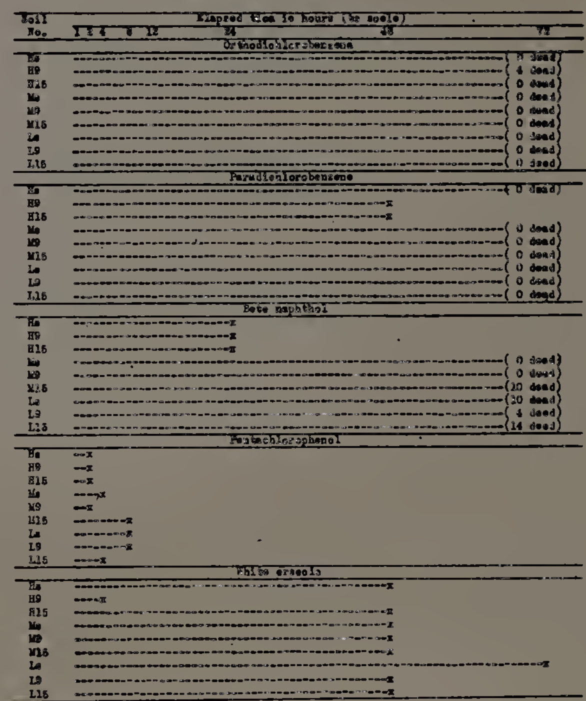
MEMPHIS TABLE 4

Toxic action to termites of soil from Memphis, Tenn., three months after treatment with various chemicals.
(Based on MEMPHIS TABLES I-3, II-3, III-4, IV-3 and V-3.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.



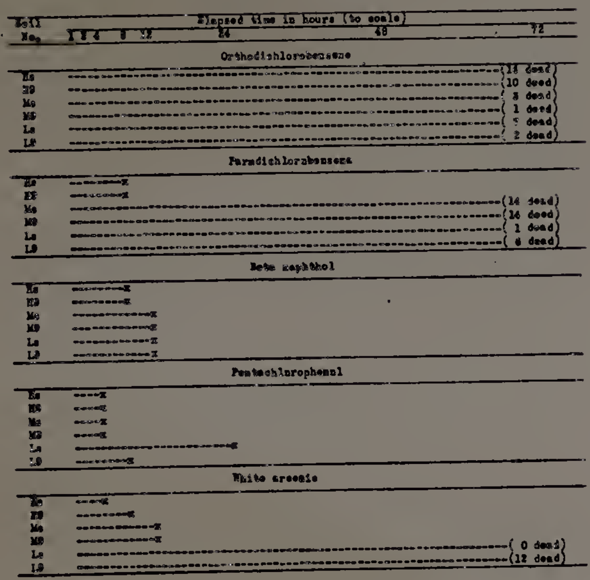
MEMPHIS TABLE 5

Toxic action to termites of soil from Memphis, Tenn., five months after treatment with various chemicals.
(Based on MEMPHIS TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.



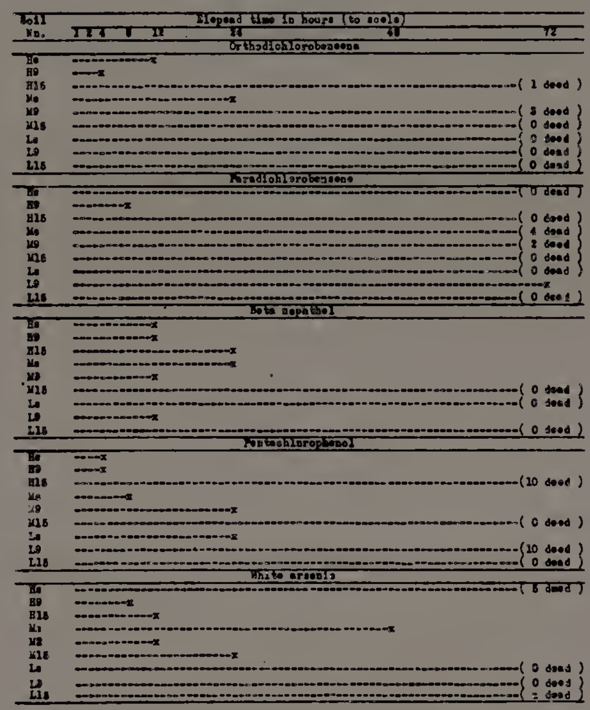
RICHMOND TABLE 0

Toxic action to termites of soil from Richmond, Va., immediately after treatment with various chemicals.
(Based on RICHMOND TABLES I-0, II-0, III-0, IV-0 and V-0.)
Length of time necessary for approximately 60% kill indicated under the appropriate hour mark.



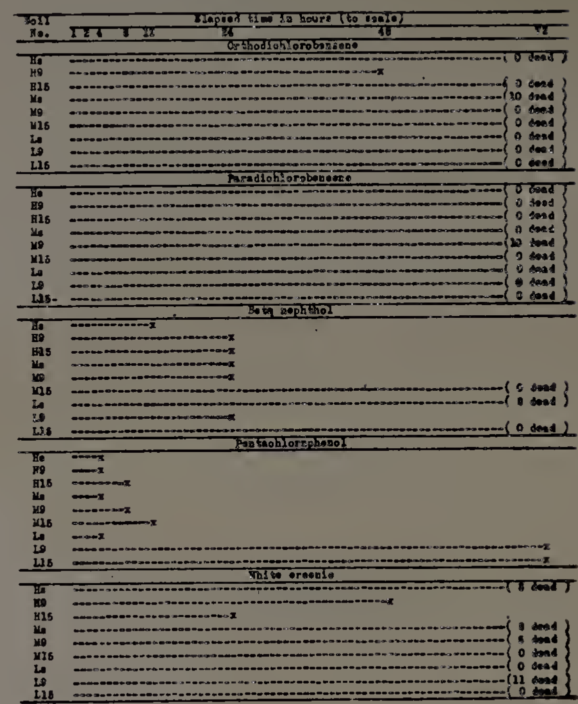
RICHMOND TABLE 1

Toxic action to termites of soil from Richmond, Va., one month after treatment with various chemicals.
(Based on RICHMOND TABLES I-1, II-1, III-1, IV-1 and V-1)
Length of time necessary for approximately 60% kill indicated under the appropriate hour mark.



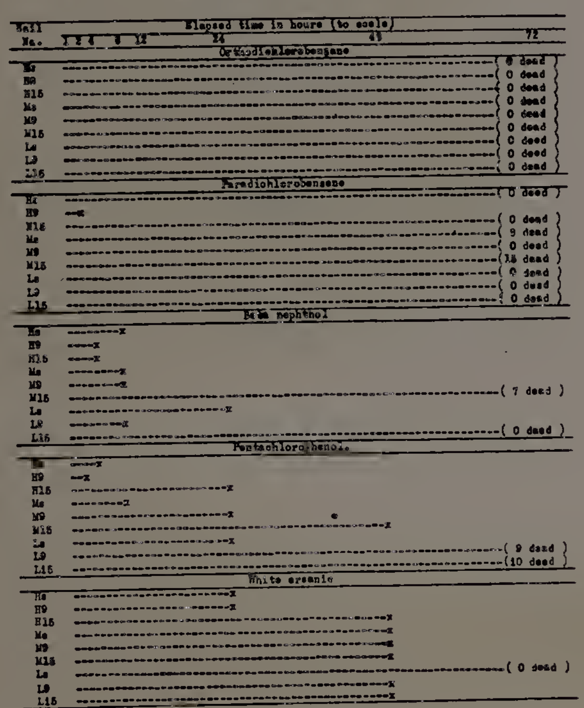
RICHMOND TABLE 2

Toxic action to termites of soil from Richmond, Va., two months after treatment with various chemicals.
(Based on RICHMOND TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 60% kill indicated under the appropriate hour mark.



RICHMOND TABLE 3

Toxic action to termites of soil from Richmond, Va., three months after treatment with various chemicals.
(Based on RICHMOND TABLES I-3, II-3, III-3, IV-3 and V-3.)
Length of time necessary for approximately 60% kill indicated under the appropriate hour mark.

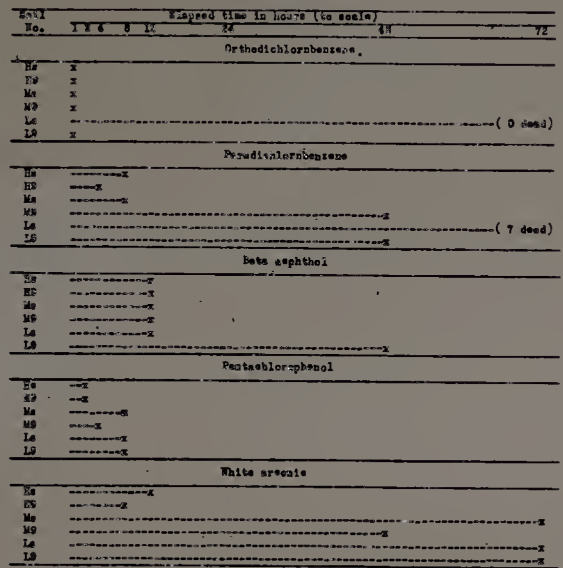


RICHMOND TABLE 5

Toxic action to termites of soil from Richmond, Va., five months after treatment with various chemicals.
(Based on RICHMOND TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 60% kill indicated under the appropriate hour mark.

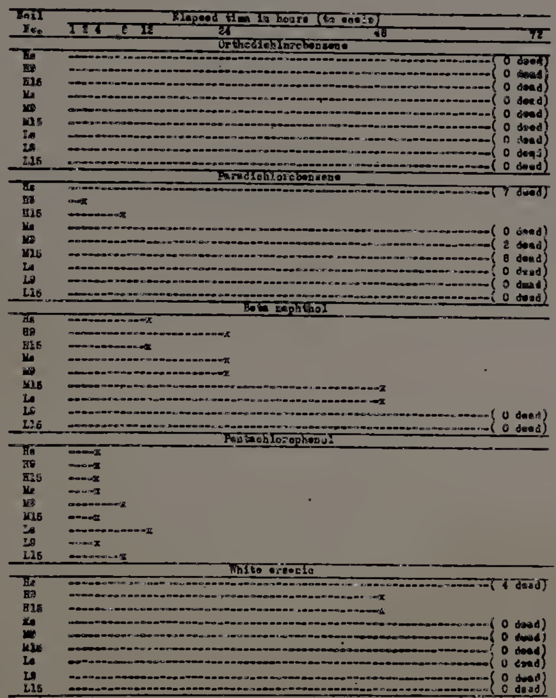
AMHERST (WD)* TABLE 0

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-0, II-0, III-0, IV-0 and V-0.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained



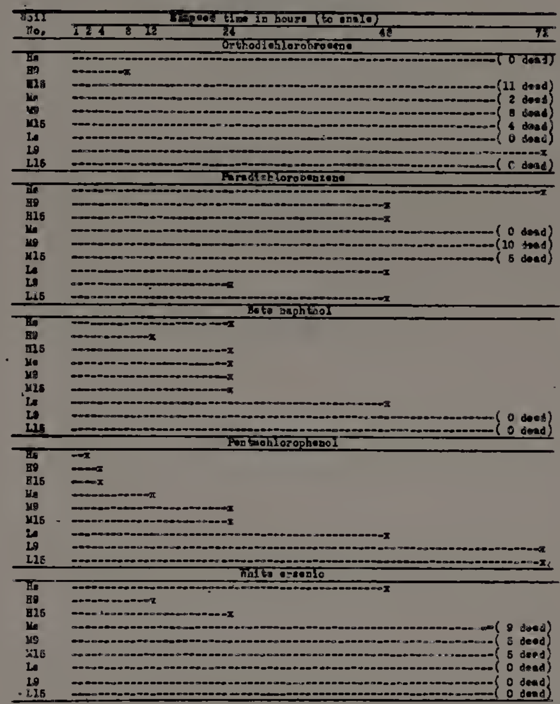
AMHERST (WD)* TABLE 5

Toxic action to termites of soil from Amherst, Mass., three months after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained



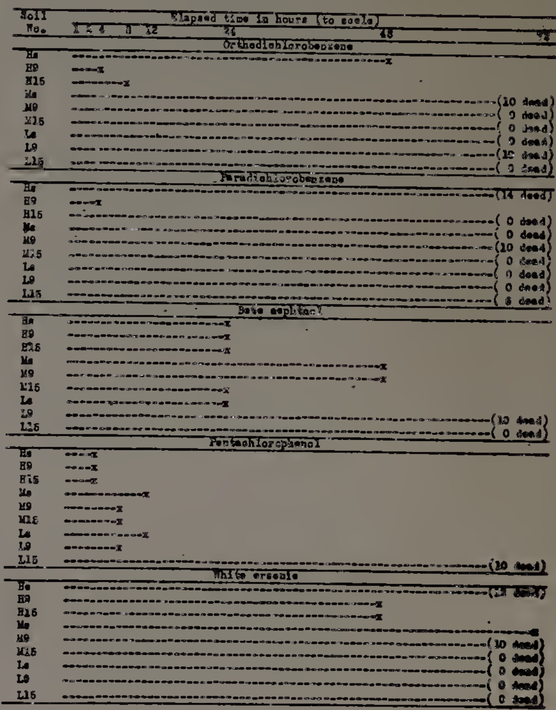
AMHERST (WD)* TABLE 1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-1, II-1, III-1, IV-1 and V-1.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained



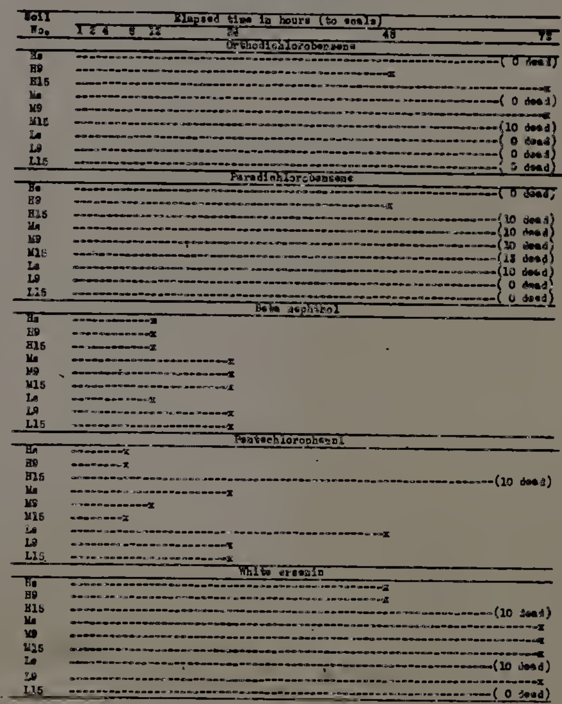
AMHERST (WD)* TABLE 2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained



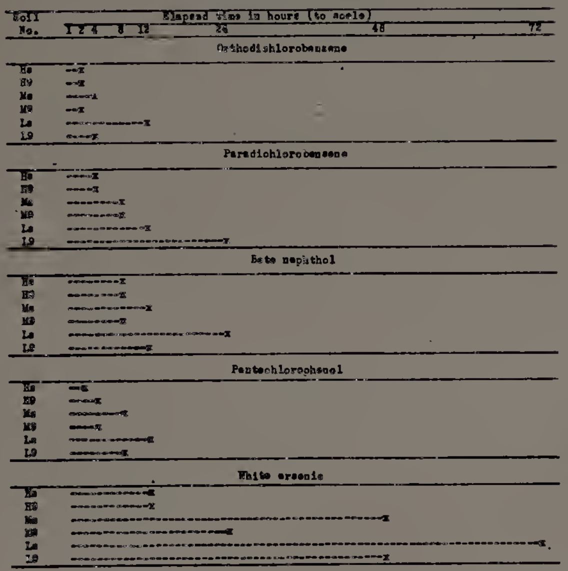
AMHERST (WD)* TABLE 6

Toxic action to termites of soil from Amherst, Mass., five months after treatment with various chemicals.
(Based on AMHERST (WD)* TABLES I-6, II-6, III-6, IV-6 and V-6.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(WD)*....Well drained



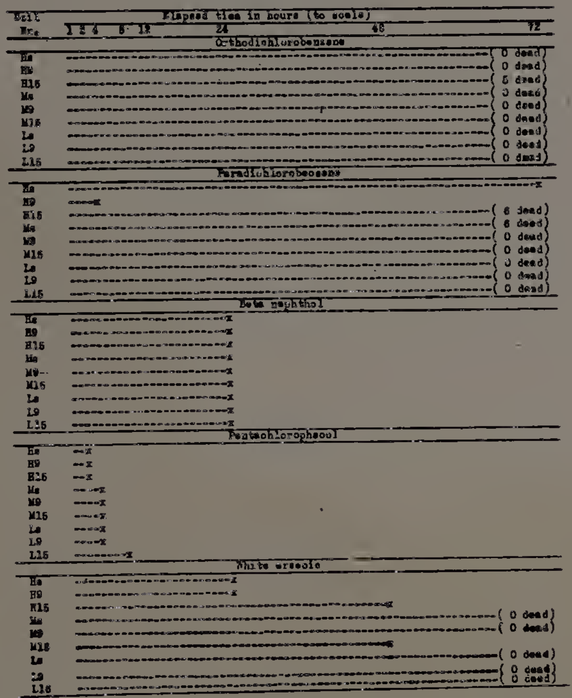
AMHERST (PD)• TABLE 0

Toxic action to termites of soil from Amherst, Mass., immediately after treatment with various chemicals.
(Based On AMHERST (PD)• TABLES I-0, II-0, III-0, IV-0 and V-0.)
Length of time necessary for approximately 50% kill indicated under the appropriate hour mark.
(PD)•....Poorly drained



AMHERST (PD)• TABLE 2

Toxic action to termites of soil from Amherst, Mass., two months after treatment with various chemicals.
(Based on AMHERST (PD)• TABLES I-2, II-2, III-2, IV-2 and V-2.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)•....Poorly drained



AMHERST (PD)• TABLE 3

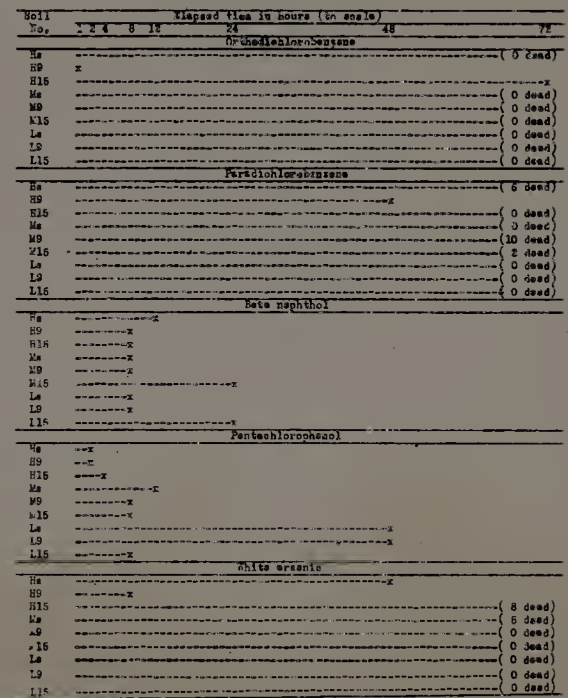
Toxic action to termites of soil from Amherst, Mass., three months after treatment with various chemicals.
(Based on AMHERST (PD)• TABLES I-3, II-3, III-3, IV-3 and V-3.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)•....Poorly drained

AMHERST (PD)• TABLE 1

Toxic action to termites of soil from Amherst, Mass., one month after treatment with various chemicals.
(Based on AMHERST (PD)• TABLES I-1, II-1, III-1, IV-1 and V-1.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)•....Poorly drained

AMHERST (PD)• TABLE 5

Toxic action to termites of soil from Amherst, Mass., five months after treatment with various chemicals.
(Based on AMHERST (PD)• TABLES I-5, II-5, III-5, IV-5 and V-5.)
Length of time necessary for approximately 80% kill indicated under the appropriate hour mark.
(PD)•....Poorly drained



Meteorological Data

From Records of U.S.D.A. Weather Observatories at Memphis, Tenn., Richmond, Va. and Amherst, Mass.

Daily mean temperature is the average of the maximum and minimum.

M - daily mean temperature

Σ_5 - sum of mean temperatures for each 5 day interval

$\bar{\Sigma}_5$ - mean temperature for each 5 day interval

Memphis, Tenn.

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
9/10/40	70			
11	58			
-12	60	325	65	
13	66			
14	71			
15	72			
16	74			
-17	77	385	77	
18	80			
19	82			
20	83			
21	83			
-22	84	405	81	
23	82			
24	73			1.88
25	60			
26	57			
-27	60	307	61.5	
28	64			
29	66			
30	67			
10/ 1/40	66			
-2	67	344	68.8	
3	70			
4	74			
5	74			
6	74			.01
-7	62	334	66.8	.15
8	60			
9	64			
10	68			
11	68			
-12	70	355	71	
13	74			
14	75			
10/15/40	58			.34
16	54			
-17	62	304	60.8	
18	58			
19	72			
20	62			
21	64			
-22	72	339	67.8	
23	70			
24	71			
25	70			
26	72			
-27	72	354	70.8	
28	74			
29	66			1.14
30	64			
31	62			.05
11/-1/40	62	316	73.2	.01
2	62			
3	66			
4	66			
5	59			.28
-6	47	268	53.6	
7	46			
8	50			
9	48			.58
10	60			.24
-11	54	238	47.2	1.18
12	42			
13	32			
14	26			
15	24			
-16	36	196	39.2	
17	52			
18	58			

Meteorological Data (cont.)

Memphis, Tenn. (cont.)

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
11/19/40	60			
20	61			
-21	64	315	63	.16
22	66			.12
23	64			.08
24	54			.03
25	50			.09
-26	50	235	47	.33
27	41			
28	40			
29	50			
30	54			.17
12/-1/40	44	219	44.8	.01
2	39			
3	32			
4	44			
5	48			
-6	50	240	48.0	.45
7	51			.36
8	47			
9	58			
10	58			
-11	62	287	57.4	.02
12	60			.59
13	49			
14	42			
15	54			1.31
-16	38	212	42.4	
17	36			
18	42			.01
19	52			
20	46			
-21	46	244	48.8	
22	48			
23	52			
24	56			.02
25	52			.02
-26	56	257	51.4	.13
27	50			.21
28	43			.04
29	48			
30	44			
-31	54	258	51.6	
1/ 1/41	58			.44
2	54			

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
1/ 3/41	42			
4	38			
-5	28	178	35.6	
6	30			
7	40			
8	48			
9	39			
-10	38	215	43.0	
11	44			
12	46			
13	56			
14	57			.26
-15	54	263	52.6	
16	56			.03
17	40			
18	28			.01
19	29			
-20	45	204	40.8	
21	50			
22	52			.35
23	46			.88
24	42			.22
-25	46	172	34.4	.29
26	44			.34
27	34			
28	32			
29	34			
-30	42	205	41.0	
31	50			
2/ 1/41	47			.04
2	41			.31
3	38			
-4	39	205	41.0	
5	43			
6	44			
7	30			
8	26			
-9	36	190	38.0	
10	46			
11	52			

Meteorological Data

Richmond, Va.

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
9/10/40	76			
11	56			
-12	60	315	63.0	
13	60			
14	63			
15	67			
16	68			
-17	66	339	67.8	
18	68			
19	70			
20	74			
21	78			
-22	74	371	74.2	
23	70			
24	75			
25	66			.52
26	52			
-27	54	290	58.0	
28	58			
29	60			
30	60			
10/ 1/40	53			1.03
-2	54	295	59.0	.03
3	64			
4	64			
5	62			
6	65			
-7	70	314	62.8	
8	61			.41
9	56			
10	56			
11	58			
-12	64	311	62.2	
13	65			
14	68			
15	66			
16	50			
-17	54	266	53.2	
18	54			
19	42			.39
20	40			
21	46			
-22	48	259	51.8	
23	56			
24	69			
10/25/40	65			
26	62			
-27	60	288	57.6	
28	53			.07
29	48			
30	60			.09
31	58			
11/-1/40	54	292	58.4	.22
2	60			.60
3	60			
4	56			
5	62			
-6	53	261	52.2	
7	46			
8	44			
9	44			
10	50			
-11	57	251	50.2	
12	56			.70
13	44			1.36
14	44			1.13
15	45			.03
-16	40	219	43.8	
17	44			
18	46			
19	46			
20	53			
-21	56	278	55.6	
22	65			
23	58			
24	52			.04
25	44			
-26	34	212	42.4	.50
27	44			
28	38			
29	40			
30	48			
12/-1/40	48	203	40.6	.01
2	38			
3	29			
4	26			
5	38			.09
-6	34	189	37.8	
7	45			.04
8	46			

Meteorological Data (cont)

Richmond, Va. (cont.)

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
12/ 9/40	40			
10	50			
-11	47	234	46.8	
12	44			
13	53			.03
14	48			.36
15	40			
-16	48	217	43.4	.17
17	42			
18	39			
19	38			
20	49			
-21	48	225	45.0	
22	46			
23	44			
24	42			
25	50			.08
-26	55	258	51.6	.03
27	54			.34
28	57			.40
29	56			.01
30	47			
-31	44	235	47.0	
1/ 1/41	44			
2	44			.43
3	43			.15
4	38			
-5	28	171	34.2	
6	30			
7	32			
8	33			
9	36			
-10	36	179	35.8	
11	34			
12	40			
13	43			
14	32			
-15	32	183	36.6	.07
16	34			1.21
17	42			

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
1/18/41	47			
19	34			
-20	30	181	36.2	
21	28			
22	42			.07
23	54			
24	41			.27
-25	37	198	39.6	
26	32			
27	34			.09
28	36			.03
29	35			
-30	38	181	36.2	
31	36			
2/ 1/41	36			
2	44			
3	36			
-4	33	185	37.0	
5	32			
6	40			
7	42			.38
8	31			
-9	33	174	34.8	
10	32			
11	36			
12	40			
13	38			.23
-14	48	204	40.8	.16
15	42			
16	36			

Meteorological Data

Amherst, Mass.

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
9/10/40	58.5			.43
11	54.5			
-12	54.5	282.0	56.4	
13	56.0			
14	58.5			
15	58.0			
16	58.5			
-17	61.5	307.0	61.4	
18	65.0			
19	64.0			
20	66.5			
21	74.0			.10
-22	64.0			
23	60.0			
24	67.0			
25	55.0			.79
26	45.0			
-27	48.0	255.5	51.1	
28	52.5			
29	55.0			
30	54.0			
10/ 1/40	49.0			
-2	57.5	269.5	52.9	
3	59.0			
4	50.0			
5	49.5			
6	59.5			
-7	67.0	287.0	57.4	
8	58.0			.36
9	53.0			
10	50.5			
11	51.5			
-12	58.0	272.5	54.5	
13	59.0			
14	53.5			
15	55.0			.15
16	41.0			
-17	37.5	204.0	40.8	
18	37.0			
19	33.5			
20	38.5			
21	34.5			
-22	33.0	200.5	40.1	
23	43.5			
24	51.0			

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
10/25/40	41.5			
26	40.5			
-27	34.5	187.5	37.5	
28	32.5			
29	38.5			
30	36.0			.31
31	44.0			.22
11/-1/40	41.5	210.5	42.1	
2	43.5			2.25
3	45.5			
4	51.0			
5	51.0			
-6	47.5	227.0	45.4	.04
7	38.0			
8	39.5			
9	39.5			
10	36.0			
-11	49.5	217.5	43.5	
12	52.0			.82
13	40.5			.32
14	39.5			.86
15	42.0			.45
-16	36.0	189.0	37.8	
17	35.5			
18	36.0			
19	35.5			
20	45.0			
-21	41.0	221.5	44.3	
22	56.0			
23	44.0			
24	40.5			.04
25	28.5			
-26	25.0	141.5	28.3	.29
27	26.0			1.01
28	21.5			
29	21.5			.05
30	32.0			.18
12/-1/40	33.0	121.0	24.2	
2	20.5			
3	14.0			
4	6.5			.18
5	26.0			.19
-6	16.5	115.0	23.0	
7	30.0			
8	36.0			

Meteorological Data (cont.)

Amherst, Mass. (cont.)

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
12/ 9/40	24.5			
10	28.0			
-11	33.0	149.5	29.9	
12	30.0			.16
13	34.0			.08
14	23.0			
15	19.5			
-16	25.5	123.0	24.6	.87
17	28.0			
18	27.0			
19	28.0			
20	36.0			.06
-21	37.0	165.5	33.1	
22	36.0			
23	28.5			
24	29.0			
25	35.0			
-26	34.0	176.0	35.2	.06
27	40.5			.02
28	37.5			1.00
29	37.5			.33
30	40.0			.06
-31	38.0	176.0	35.2	
1/ 1/41	33.0			
2	27.5			.17
3	30.0			.13
4	30.0			.25
-5	25.5	123.5	24.7	
6	22.5			
7	15.5			
8	15.0			
9	14.0			.03
-10	24.5	96.5	19.3	
11	21.0			
12	22.0			.01
13	16.5			
14	6.5			
-15	11.5	82.0	16.4	
16	18.5			.22
17	29.0			.35
18	34.0			
19	24.5			
-20	15.5	119.0	23.8	
21	18.5			
22	26.5			

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
1/23/41	33.5			
24	19.5			1.05
-25	23.5	109.0	21.8	
26	16.0			
27	16.5			
28	21.5			
29	20.5			
-30	4.5	87.5	17.5	
31	19.5			
2/ 1/41	21.5			
2	25.0			.03
3	24.0			
-4	25.5	114.5	22.9	
5	21.0			
6	19.0			
7	36.5			1.39
8	37.5			
-9	23.5	138.0	27.6	
10	16.0			
11	24.5			
12	26.5			
13	29.0			
-14	35.5	143.5	28.7	
15	31.0			.11
16	21.5			
17	21.0			.02
18	22.5			
-19	22.0	120.0	24.0	
20	25.0			
21	29.5			
22	31.0			
23	31.0			
-24	25.5	138.5	27.7	
25	27.0			
26	24.0			
27	25.5			
28	20.0			.04
3/-1/41	30.0			.02
2	33.5	146.5	29.3	
3	37.5			

Meteorological Data (cont.)

Amherst, Mass. (cont.)

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
3/ 4/41	29.5			
5	24.5			
-6	27.5	134.5	26.9	
7	24.5			
8	28.5			.67
9	28.0			
10	28.0			
-11	24.5	132.5	26.5	.65
12	27.0			
13	25.0			

Date	M	Σ_5	$\bar{\Sigma}_5$	Pptn.
3/14/41	26.0			
15	30.0			
-16	36.0	130.0	26.0	
17	27.0			.19
18	11.0			
19	20.5			
20	27.5			
-21	28.0	146.5	29.3	
22	31.5			
23	39.0			

Summary of meteorological data from Memphis, Tenn.,
Richmond, Va., and Amherst, Mass.
(Based on data in preceding tables)

Average temperature for each monthly or two-monthly period, and since the original application of chemical, shown in columns headed Temperature.
Precipitation for each monthly or two-monthly period, and total precipitation since original application of chemical shown in columns headed Precipitation.

Area	Elapsed time in months since original treatment															
	1				2				3				5			
	Temperature		Precipitation		Temperature		Precipitation		Temperature		Precipitation		Temperature		Precipitation	
	A	X	A	X	A	X	A	X	A	X	A	X	A	X	A	X
Memphis	69.9	69.9	2.04	2.04	63.7	66.8	3.82	5.86	48.3	60.6	1.82	7.68	46.2	54.9	5.50	13.18
Richmond	64.0	64.0	1.99	1.99	52.9	58.5	4.59	6.58	44.5	53.8	1.24	7.82	40.4	48.4	3.95	11.77
Amherst(WD)	49.2	49.2	.51	.51	41.3	45.3	5.60	6.11	27.0	39.7	2.80	8.91	24.8	33.4	5.17	14.08
Amherst(PD)	41.0	41.0	5.26	5.26	28.5	34.8	3.09	8.35	26.8	32.1	2.63	10.98	25.0	29.3	4.26	15.24

A ---- average temperature or absolute precipitation for the period indicated.

X ---- average temperature or total precipitation since the original application of the chemicals.

Dates of establishment and sampling of the various test plots.

Area	Date of establishment	1 month sample	2 month sample	3 month sample	5 month sample
Memphis	9/11/40	10/11/40	11/11/40	12/11/40	2/11/41
Richmond	9/15/40	10/15/40	11/15/40	12/15/40	2/15/40
Amherst(WD)	9/24/40	10/24/40	11/24/40	12/24/40	2/24/40
Amherst(PD)	10/19/40	11/19/40	12/19/40	1/19/41	3/19/41

The following topics will be discussed in connection with each of the chemicals tested.

B. Establishment of a uniformly toxic barrier.

The first series of samples ("0" series) were taken from the test plots as the chemical was applied; all subsequent samples were taken by digging a small hole in the treated area. Samples for the 1-month series were taken from the holes made on the north side of the stakes, for the 2-month series, from the south side, for the 3-month series, from the east side and for the 5-month series, from the west side. The uniformity of application of the various chemicals may be indicated by the results of the tests of samples from each level.

Penetration below level of original application.

Since the chemicals were applied to a depth of 9", tests on samples from a depth of 15" may indicate the speed of penetration of the toxicant below the depth of original application.

C. Permanence of the toxic barriers.

1. Influence of weather.
   a. Temperature
   b. Precipitation
2. Influence of drainage.

Orthodichlorobenzene

B. Establishment of a uniformly toxic barrier.

Orthodichlorobenzene gave excellent results in all samples taken immediately after application of the toxicant, with the exception of the samples from Richmond, Virginia. However, since a large number of the samples taken at one month after treatment were negative, and this number increased with each succeeding series of samples, a uniformly toxic barrier was not obtained at any time after the original application of the chemical.

Penetration below level of original application.

There was some penetration below the level of original application since some 15" samples were 'toxic' or 'slightly toxic' (MEMPHIS TABLES I and II, AMHERST (WD) TABLES I, II and V, and AMHERST (PD) TABLES II and V), indicating that orthodichlorobenzene does penetrate below the level of original application to some extent.

C. Permanence of the toxic barrier.

Although there was a very short duration of toxicity in all areas, it will be noted that in some cases, samples from 9" and 15" were much more toxic than samples taken from the surface (AMHERST (WD) TABLES I and V, AMHERST (PD) TABLES I and V, and MEMPHIS TABLE I). While these results are not conclusive, there is the indication, nevertheless, that soils treated with orthodichlorobenzene remain slightly toxic at depths of 9" and 15" for a short time after the poison has been lost from the surface layers.

1. Influence of weather

a. Influence of temperature

Although a large number of the samples had lost their toxicity to termites by the end of the test period, more 'toxic' and 'slightly toxic" samples were obtained from the two Amherst areas than were obtained from the Richmond and Memphis areas, at three months and five months after application of the chemical. The two Amherst areas had a combined total of 7 'toxic' and 'slightly toxic' samples, while the Memphis and Richmond areas had a combined total of 2 'toxic' and 'slightly toxic' samples. The average temperatures for the five-monthly period in the Amherst areas were much lower than were the average temperatures for the same periods in the Memphis and Richmond areas: (summary table of meteorological data)

Area	Average Temperature ° F.
Memphis	54.9
Richmond	48.4
Amherst (WD)	33.4
Amherst (PD)	

b. Influence of rainfall.

Under the test conditions, rainfall exerts little influence on the duration of toxicity of soils treated with orthodichlorobenzene. Although there was slightly more precipitation on the two Amherst areas than on the Richmond and Memphis areas, (see meteorological summary table) the number of 'toxic' samples from the two Amherst areas was slightly higher than the number of 'toxic' samples from the Richmond and Memphis areas (see section a).

2. Influence of drainage.

Since there was little or no difference between the results of the tests of the samples from the well-drained and poorly-drained areas, (see AMHERST (PD) TABLES and AMHERST (WD) TABLES) the data indicate that, under the test conditions, drainage has little or no effect on the duration of toxicity of soil treated with orthodichlorobenzene over a period of five months.

Paradichlorobenzene

B. Establishment of a uniformly toxic barrier

Paradichlorobenzene gave very poor results in the tests conducted immediately after the original application of the various chemicals. The number of negative samples increased greatly with each successive set of samples, indicating that a uniformly toxic barrier was not obtained at any time.

Penetration below level of original application.

Penetration below the level of original application took place in all areas, since some 15" samples were 'toxic' or 'slightly toxic' (MEMPHIS TABLES II and III, AMHERST (WD) TABLES I, II, III and V, and AMHERST (WD) TABLES I, II and V). It is also of interest to note the correlation between the number of 15" samples exhibiting at least some toxicity from each area and the total precipitation on each of the test areas.

Area	No. of 15" samples, at least slightly toxic	Total Precipitation
Memphis	3	13.18
Richmond	1	11.77
Amherst (WD)	7	14.08
Amherst (PD)	5	13.5

Although the differences in rainfall are not very great, some indication is provided that paradichlorobenzene is actually carried below the level of original application by the passage downward of water which has fallen on the ground in the form of rain.

C. Permanence of the toxic barrier.

Although there was a very short duration of toxicity in all areas, some samples from 9" amd 15" were much more toxic than were samples taken from the surface (MEMPHIS TABLE V, RICHMOND TABLES I, II, III and V, AM-

HERST (WD) TABLES I, II, III and V, and AMHERST (PD) TABLES I, II and V). These results show conclusively that soil treated with paradichlorobenzene may remain toxic at depths of 9" and 15", although the soil at the surface has become non-toxic.

1. Influence of weather.

a. Influence of temperature.

Although a large number of the samples had lost their toxicity to termites by the end of the test period, more 'toxic' and 'slightly toxic' samples were obtained from the two Amherst areas than were obtained from the Memphis and Richmond areas, at three months and five months after application of the chemical. The two Amherst areas had a combined total of 19 'toxic' and 'slightly toxic' samples, while the Richmond and Memphis areas had a combined total of 11 'toxic' and 'slightly toxic' samples.) The average temperatures for the five-monthly periods in the Amherst areas were much lower than were the average temperatures for the same periods in the Memphis and Richmond areas (see section C-1-a under orthodichlorobenzene), indicating conclusively that high temperatures shorten the duration of toxicity of soils treated with paradichlorobenzene.

b. Influence of rainfall.

Under the test conditions, rainfall exerted little influence on the duration of toxicity of the soils treated with paradichlorobenzene. Although there was slightly more precipitation on the two Amherst areas than on the Richmond and Memphis areas (see meteorological summary table) the number of 'toxic' samples from the two Amherst areas was almost twice as large as the number of 'toxic' samples from the Richmond and Memphis areas.

2. Influence of drainage.

Since there was little difference between the results of the tests of the samples from the well-drained and poorly-drained areas (AMHERST (PD) TABLES and AMHERST (WD) TABLES), drainage has little or no effect on the duration of toxicity of soil treated with paradichlorobenzene under the test conditions.

Beta naphthol

B. Establishment of a uniformly toxic barrier.

Beta naphthol gave excellent results in all samples taken immediately after the application of the toxicant. However, the samples taken at one month and two months after application of the chemical, (with the exception of the Memphis series) did not give quite as rapid kills, on the whole, as did the samples taken at three and five months after application of the chemical. Under the conditions of the tests, the most uniformly toxic barriers developed in from three to five months after the original application of the chemical.

Penetration below the level of original application.

There is a very noticeable increase in the toxicity of the 15" samples especially in those from Memphis (MEMPHIS TABLES I, II and III) and those from Amherst (PD) (AMHERST (PD) TABLES I, II, III and V). By the end of the test period (5 months) only one 15" sample was negative, although five were negative at the start of the test period. The areas having the most uniformly toxic barriers (the two areas in Amherst) have had the most precipitation (see meteorological summary table) indicating a positive correlation between the amount of rainfall and the rapidity of formation of uniformly toxic barriers of beta naphthol in treated soil.

C. Permanence of the toxic barrier.

1. Influence of weather

a. Influence of temperature.

The speed of killing in the samples from Amherst and Richmond gradually increased during the experimental period, (AMHERST (PD) TABLES I-V, AMHERST (WD) TABLES I-V, RICHMOND TABLES I-V) while the speed of killing in the samples from Memphis reached its maximum in the three- month samples, (MEMPHIS TABLES I-V). There is a marked correlation between the average temperatures for the five-monthly period and the toxicity of the various five-monthly samples as shown in the following table:

Area	No. of very toxic samples	Av. time in hours to kill in toxic samples	Aver. temperature 5-monthly period
Memphis	3	24	54.9
Richmond	8	20	48.4
Amherst (WD)	9	19	33.4
Amherst (PD)	9	11	29.3

This data indicates that high temperatures shorten the duration of toxicity of soil treated with beta naphthol.

b. Influence of precipitation.

Under the conditions of the tests, precipitation had little if any effect on the duration of toxicity of the treated soils in the various areas.

2. Influence of drainage.

Rapid kills were obtained with samples from the well-drained and poorly-drained areas in Amherst. The speed of killing in the samples from the poorly-drained area was slightly and more uniformly faster than the speed of killing in the samples from the well-drained area, indicating only that a more uniformly toxic barrier is established in less time in poorly-drained soils than in well-drained soils. No conclusions can be drawn concerning the influence of drainage on the permanency of the barrier.

Pentachlorophenol

B. Establishment of a uniformly toxic barrier.

In all samples taken immediately after the application of the toxicant, pentachlorophenol gave rapid kills. However, the samples taken at one month and five months after the application of the chemical (with the exception of the Richmond series) did not give quite as rapid kills, on the whole, as did the samples taken at two and three months after the application of the chemical, indicating that under the conditions of the tests, the most uniformly toxic barrier developed two to three months after the application of the chemical.

Penetration below the level of original application.

There is a very noticeable increase in the toxicity of the 15" samples especially in those from the areas in Memphis and Richmond and the well-drained area in Amherst (MEMPHIS TABLES I-V, RICHMOND TABLES I-V, and AMHERST (WD) TABLES I-V). The most uniformly toxic barrier was developed after approximately eight inches of rain had fallen on each of the areas (see meteorological summary table).

C. Permanence of a uniformly toxic barrier.

1. Influence of weather.

a. Influence of temperature

Temperature seems to have little effect on the duration of toxicity in the various samples, since the most rapid kill in the 5-month samples took place in those from Memphis (this area had the highest average temperature), while the least rapid kill in the 5-month samples took place in those from the well-drained area in Amherst (this area had almost the lowest average temperature).

b. Influence of precipitation.

This factor, under the test conditions, is unimportant in determining the duration of toxicity of pentachlorophenol in treated soil, since there is no correlation between the average time to kill in toxic 5-month samples and the total precipitation, as shown in the following table:

Area	Total Precipitation	Aver. time to kill in toxic 5-month samples
Memphis	13.18	4
Richmond	11.17	9
Amherst (WD)	14.08	24
Amherst (PD)	15.24	16

2. Influence of drainage.

Rapid kills were obtained with samples from the well-drained and poorly-drained areas in Amherst. The speed of killing in the samples from the poorly-drained area was slightly and more uniformly faster than the speed of killing in the samples from the well-drained area, indicating only that a more uniformly toxic barrier is established faster in poorly drained soils than in well-drained soils. No conclusions can be drawn concerning the influence of drainage on the permanency of the barrier.

White arsenic

B. Establishment of a uniformly toxic barrier.

The establishment of a uniformly toxic barrier with this chemical took place only in the Memphis and Richmond areas, at five months and three months respectively (MEMPHIS TABLES I-V, RICHMOND TABLES I-V). However, the results from month to month, even in these instances, were so inconsistent that no conclusions can be drawn in connection with the length of time necessary for the establishment of a uniformly toxic barrier. There appears to be little correlation between rainfall and establishment of the barrier.

Penetration below the level of original application.

Penetration below the level of original application took place, but there appears to be little correlation between rainfall and degree of penetration below nine inches.

C. Permanence of the toxic barrier.

1. Influence of the weather.

a. <u>Temperature</u>

Since white arsenic is an inorganic compound, and is not volatile at ordinary temperatures, the effect of temperature on the permanency of the chemical in treated soil is negligible.

b. <u>Precipitation</u>

There is a marked correlation between the toxicities of the 5-month samples from the various areas and the total precipitation on each of the areas (METEOROLOGICAL SUMMARY TABLE, MEMPHIS TABLE V, RICHMOND TABLE V, AMHERST (WD) TABLE V and AMHERST (PD) TABLE V). The 5-monthly samples from the Richmond area (area having least precipitation), although they are not as <u>uniformly</u> toxic as the samples from the Memphis area, on the whole, gave slightly faster kills. The 5-monthly samples from the Amherst (PD) area (area having most precipitation) proved to be the least toxic. It is evident, therefore, that rainfall is the most important factor controlling the permanency of toxicity of soil treated with white arsenic.

2. <u>Influence of drainage</u>.

The 5-monthly samples from the poorly-drained area are much less toxic than those from the well-drained area (AMHERST (PD) TABLE V, AMHERST (WD) TABLE V). The water tables in this area varied from six inches to fifteen inches below the surface, and undoubtedly contributed greatly to the loss by the soil of the highly soluble white arsenic.

Summary

I. The effectiveness of beta naphthol as a soil poison for termites.

A. The nature of the toxic action of beta naphthol.

Experiments on the toxic action of beta naphthol indicate that this chemical functions as a:

1. Fumigant poison (pages 54 to 59)
2. Stomach poison (pages 59 to 61)
3. Repellent (pages 61 to 66)

B. The minimum amount of beta naphthol necessary to keep termites from penetrating treated soil.

Experiments on the minimum amount of beta naphthol necessary to keep termites from penetrating treated soil indicate that different soils require different amounts of chemical varying from .02 grams per 30 grams of soil to .30 grams per 30 grams of soil (pages 74 to 76).

C. The influence of various properties of soils on the toxic action of beta naphthol.

Tests on the influence of various properties of soils indicate that:

1. The influence of the particle size of the soil is negligible (pages 65 to 75).

2. Small sized particles of toxicant are more effective than large size particles of toxicant (pages 71 to 75).

3. Organic matter is the principal factor governing the toxicity of beta naphthol in treated soil, and that soils having a high percentage of organic matter require a higher concentration of beta naphthol to keep termites from penetrating than do soils having a low percentage of organic matter (pages 68 to 75).

II. The relative duration of toxicity of beta naphthol, pentachlorophenol, white arsenic, paradichlorobenzene and orthodichlorobenzene when used as soil poisons for termites under field conditions.

A. Initial toxicity of the various chemicals.

Experiments on the initial toxicity of the various chemicals indicate that orthodichlorobenzene was the most toxic, and paradichlorobenzene the least toxic of the chemicals tested. Pentachlorophenol was almost as toxic as orthodichlorobenzene and beta naphthol was almost as toxic as pentachlorophenol. White arsenic was slightly more toxic than paradichlorobenzene.

Influence of organic matter.

The presence of organic matter slightly increased the toxicity of orthodichlorobenzene and paradichlorobenzene, had little if any effect on the toxicity of white arsenic and pentachlorophenol, and slightly decreased the toxicity of beta naphthol.

B. Uniformity of the barriers established with the various chemicals.

A uniformly toxic barrier was not obtained with orthodichlorobenzene and paradichlorobenzene, and was obtained in only two areas out of the total of four, with white arsenic. A uniformly toxic barrier developed in two to three months with pentachlorophenol and three to five months with beta naphthol.

Penetration below the level of original application.

Penetration below the level of original application took place with all chemicals, and in all areas, tested.

C. Tests on the permanence of the toxic barriers.

The barriers established with pentachlorophenol and beta naphthol were still very toxic at five months, while the barriers established with white arsenic were fairly toxic at five months. Orthodichlorobenzene and paradichlorobenzene were only effective immediately after original application.

1. Influence of weather.

a. Temperature

High temperatures decreased the duration of toxicity of orthodichlorobenzene, paradichlorobenzene, pentachlorophenol and beta naphthol, and had little if any effect on the duration of toxicity of white arsenic.

b. Precipitation

Rainfall had relatively little effect on the duration of toxicity of pentachlorophenol, beta naphthol, orthodichlorobenzene, and paradichlorobenzene, but greatly decreased the duration of toxicity of white arsenic.

2. Influence of drainage.

Drainage had relatively little effect on the duration of toxicity of pentachlorophenol, beta naphthol, orthodichlorobenzene and paradichlorobenzene, but greatly decreased the duration of toxicity of white arsenic.

Conclusions

1. Beta naphthol functions as a fumigant poison, as a stomach poison, and as a repellent, to termites.

2. The minimum amount of beta naphthol necessary to keep termites from penetrating treated soil, varies from soil to soil, and is dependent upon the percentage of organic matter present in any specific soil.

3. The toxicity of beta naphthol to termites is inversely proportional to the size of the particles of toxicant.

4. Five months after the application of the chemical, soil treated with beta naphthol at the rate of one-quarter pound, one-half pound and two pounds per cubic foot, is still toxic to termites.

5. Orthodichlorobenzene is highly toxic to termites immediately after its application to soil.

6. Soil treated with orthodichlorobenzene loses its toxicity within one to two months.

7. Soil treated with orthodichlorobenzene loses its toxicity in the surface layers first.

8. Paradichlorobenzene is fairly toxic to termites, but soil treated with this chemical loses its toxicity in one to two months.

9. Termites are able to penetrate soil treated with white arsenic although this chemical is reasonable effective as a stomach poison.

10. Five months after application of the chemical, soil treated with pentachlorophenol at the rate of one-quarter pound, one-half pound and two pounds per cubic foot, is still toxic to termites.

11. The presence of organic matter decreases the effectiveness of beta naphthol, and increases the effectiveness of paradichlorobenzene and orthodichlorobenzene,

12. High temperatures decrease the duration of toxicity of soils treated with orthodichlorobenzene, paradichlorobenzene, pentachlorophenol and beta naphthol.

13. Precipitation and poor drainage decrease the duration of toxicity of soils treated with white arsenic.

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